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Native American-White Differences in Adult Health

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Native American-White Differences in Adult Health

by

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To my mother, Mei-Tzu Leu

And

In memory of my father, Kuen-Huo Wang

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Native American-White Differences in Adult Health

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The goal of this work is to document the health gaps between Native Americans and non-Hispanic Whites using a recent, consistent, and national-level dataset—the National Health Interview Survey. I find that Native Americans have poorer self-reported health and more activity limitations than Whites; Native Americans are more likely to have no doctor visits than Whites; Native Americans spend more days in bed than Whites. Further, Native American-White differences in activity limitations and bed days are completely mediated by socioeconomic factors. SES also accounts for a large portion of the racial gap in self-reported health and physician utilization. The racial gap in self-reported health between Native Americans and Whites narrows with age. However, similar patterns for activity limitations, bed days, and doctor visits are not observed. Although it is found that Native Americans living in metropolitan areas have better self-reported health than Native Americans living in non-metropolitan

areas, non-MSA Native Americans are less likely to have an activity limitation and more likely to have no doctor visits than MSA Native Americans. With the exception of doctor visits, the health gaps between Native Americans and Whites in non-MSA areas are narrower than those in MSA areas. When SES or health variables are controlled, all racial gaps in non-MSA areas are narrower than those in MSA areas. With respect to mortality, Native Americans are found to have a higher risk than Whites and the risk of death for Native Americans versus Whites declines with age. Compared to Whites, Native Americans are less likely to drink but they are more likely to drink heavily. Generally, Native Americans are more likely to smoke than Whites; however, they do not necessarily smoke more heavily than Whites, especially after controlling for SES. Native Americans are more likely to be physically inactive compared to non-Hispanic Whites.

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CHAPTER 1

STATEMENT OF THE PROBLEM AND STUDY AIMS

The problem

Health is important to everyone. But some categories of people are healthier than others. Although relatively little research has focused on Native Americans, it seems clear that this population is characterized by poor health and poorer access to health services than any other minority group in the United States, with the possible exception of African Americans (McGee et. al, 1999).

What is health? The World Health Organization defined it as: "physical, mental, and social well-being, and not merely the absence of disease or infirmity (WHO, 1946:3)." By this definition, it is apparent that health is much more than a biological issue and involves important social and psychological components (Williams and Collins, 1995; Hummer et. al., 1998). Further, health has long been an indicator of inequality among population groups (Frisbie and Bean, 1978). That is, to some extent, social inequality is likely a major reason that some categories of people have better health than others.

Over time, the health status for all races in the U.S. has improved, but the gaps between races remain. For example, the life expectancy for Whites rose to 76.5 in 1995 from 72.2 in 1973 and that for Native Americans increased from 63.5 in 1973 to 71.1 in 1995 (Indian Health Service, 1999). The gap had narrowed appreciably by the 1980s, but there was no further improvement by the 1990s.

While life expectancy increased, the crude death rate for each group decreased. The crude death rate for Whites decreased from 6.59 in 1973 to 4.76 in 1995, and that for Native Americans went down to 6.99 in 1995 from 10.07 in 1973. Unlike the trend of Whites, the crude death rate for Native Americans fluctuated. It went down to 5.94 per 1,000 in 1992 but increased to 6.99 per 1,000 in 1995 (Indian Health Service, 1999).

Table 1.1: Life Expectancy and Crude Death Rates in the U.S., 1972-1999

	Life Expectancy at Birth		Crude Death Rate (Per 1,000)	
Year\ Race	N.A.	White	N.A.	White
1972-1974[a]	63.5	72.2	10.07	6.59
1982-1984	72.0	75.2	6.38	5.28
1991-1993	73.2	76.5	5.94	4.78
1994-1996[b]	71.1	76.5	6.99	4.76

Source[a]: Indian Health Service, 1997
Source[b]: Indian Health Service, 1999

As shown in Table 1.1, overall, the mortality rates have not only dropped for Native Americans, but their life expectancy has increased as well. These improvements are influenced by improved sanitation, nutrition, and medical technology (Young, 1994). But do these improvements mean that Native Americans are nearly as healthy as Whites? As mortality rates decrease for all races and become convergent, this indicator may be less important in understanding the real racial gap in health status. That is, since mortality rates do not fully satisfy the need to understand the racial gap in health status, other indicators of health come to play an important role in this sense.

The major reduction in mortality rates among Native Americans in the 1980s shown above should be interpreted carefully because the Native American

population has changed over time. Notice, for example, the large increase in the size of this population group in the 1970s and 1980s (see Table 1.2, details discussed in Chapter Two). T

hose who claimed to be Native Americans in the 1980s and 1990s, but not in the earlier years, may improve the health status of the population as a whole because many are Native Americans with relatively better socioeconomic status living in metropolitan areas (Snipp, 1997; Eschbach et. al, 1998). Therefore, these "new" Native Americans might mask the more disadvantaged health status and survival chances of reservation Native Americans. That is, the health of reservation Native Americans with relatively disadvantaged socioeconomic

Table 1.2: The Size of the Native Americans Population, 1900-2000

Year	Population
1900	237,196
1910	276,927
1920	244,437
1930	343,352
1940	345,252
1950	357,499
1960	523,591
1970	792,730
1980	1,478,523
1990	1,959,234
2000	2,475,956

Source: Bureau of the Census, 1970, 1980, 1993, 2000b.

status might not have improved as much as overall rates suggest. Hence, it is important to examine the health differences of reservation and non-reservation

Native Americans or, at least, to examine the health status of Native Americans who live in metropolitan and non-metropolitan areas, respectively.

Research also reveals that the health of Native Americans has changed substantially since the 1950s (Young, 1994, 1997). Several key epidemiological trends have been pointed out that include the decline but persistence of infectious diseases, the rise in chronic diseases, and the continued importance of social pathologies.

The theory of "epidemiological transition" has often been used to describe the health changes of human populations over time (Omran, 1971, 1977). According to Omran, the transition of health includes three stages: the era of pestilence and famines, the era of receding pandemics, and the era of degenerative and man-made disease. In light of the increase of disease associated with social pathologies such as AIDS, alcohol-related disease, and so on, a fourth stage, called the hybristic stage, has also been added to the epidemiological transition theory (Rogers and Hackenberg, 1987). To some extent, the health transition of Native Americans seems to follow the pattern outlined in the epidemiological transition theory, but this conclusion is very tentative due to scarce data on Native Americans in the past and present (Young, 1994). Thus, data and research relate to the health of Native Americans are urgently needed.

MAJOR RESEARCH HYPOTHESES

As reported earlier, the life expectancy of both Whites and Native Americans have increased, and the gap is narrowing. But does the extension of life imply better relative health? Fries (1980) suggests that mortality decline is associated with an expansion of active life, and a delay in both morbidity and mortality. Simply put, longer life will lead to the compression of morbidity. Verbrugge (1984), however, argues that the onset of disease may stay the same, even as life expectancy increases. Therefore, longer life may bring the extension of suffering from chronic diseases, specifically for the elderly.

Based on the above debate, an empirical study by Hayward and Heron (1999) concludes that longer life with better health is not a characteristic of Native Americans. In their study, Native Americans have the longest period of inactive life of any U.S. race/ethnic group, though their mortality rates are relatively low, and life expectancy is relatively long. That is, compared with Blacks and Hispanics, Native Americans have longer life expectancy, but they also suffer, on average, from a longer period of chronic diseases. Both Native Americans and Blacks suffer from a long period of chronic diseases, but Native Americans on average live more years than Blacks. Whites and Asian Americans, of course, are more advantaged groups. They live longer with longer periods of good health (Hayward and Heron, 1999).

In fact, much of the limited research on Native Americans focuses on infant mortality; few studies specifically address the health of the elderly. But it has been reported that the survival chances of Native Americans improve relative to Whites beyond age 45 (Snipp, 1997). Indeed, Table 1.3 shows that the ratios of age-specific death rates decrease throughout adulthood, and there is a crossover at the age group of 85 and above. Thus, it might be expected that the health status of Native Americans relative to Whites might improve with age. However, this important hypothesis has not been tested with health data in a rigorous fashion. That is necessary before a firm conclusion about race, age, and health is reached. Note that a similar cross-over can be found in the comparison of African Americans and Whites; however, some researchers suggest the cross-over at older ages may be due to age misreporting among the elderly (e.g., Preston et al., 1996; Hummer et.al., 2002).

Table 1.3:
The Ratio of Age-Specific Death Rates Between Native Americans and Whites

Age Group	N.A. / White
25-34	2.4
35-44	2.1
45-54	1.9
55-64	1.5
65-74	1.2
75-84	1.0
85+	0.8

Source: Indian Health Service, 1997

Let us briefly discuss this in regard to two different hypotheses: "double jeopardy" and selection. The notion of "double jeopardy" may be applied to the

effects of age on Native Americans, as well as other disadvantaged groups. For example, Dowd and Bengston (1978) view the minority aged as a double-burdened population. That is, unlike the majority, members of minority groups are often socioeconomically disadvantaged and subject to discrimination. This implies a greater exposure to hazards throughout the life course which can be costly to health and may be expected to have a cumulative effect such that the health and mortality gaps between the majority and minority populations increase with age. By contrast, what might be termed the "selection hypotheses" (Nam, 1995) views "age as leveler" (Dowd and Bengston, 1978: 427). That is, the majority-minority differential might be expected to narrow over the life course as the frailest among the disadvantaged group die at younger ages, while the frailest in the advantaged group survive longer due to greater economic and health resources. If so, the health and mortality gaps would close with age.

The latter appears to be more congruent with the experience of Native Americans. Various studies indicate that the survival chances of this group, relative to Whites, improve after age 45 and that Native Americans actually enjoy a modest survival advantage at the oldest ages (Fingerhut and Makuc, 1992; Snipp, 1997).

As mentioned earlier, socioeconomic and demographic conditions are not only critical for understanding health and mortality patterns, but geographic factors are as well. Native Americans are experiencing a dramatic change in

health (Young, 1994, 1997). Life expectancy, infant mortality, and mortality from tuberculosis have apparently converged with that of the total population to a great degree (Markides, 1983; Young, 1994, 1997). However, such improvement in mortality, especially after the 1980s, may be associated with the emergence of newly self-identified Native Americans (Passell, 1997). Furthermore, the internal differences between reservation and non-reservation Indians within the Native American population cannot be neglected. This effect can be indirectly observed in metropolitan/non-metropolitan differences (Thornton, Sandefur, and Grasmick, 1982). Kenen and Hammerslough (1985) also report that non-reservation Native Americans have lower mortality rates than Native Americans living on reservations.

Generally, Native Americans residing on reservations are more socioeconomically disadvantaged. For instance, the 1989 per capita income for Native Americans living on reservations and trust lands is $4,478 while that for all Native Americans is $8,328 (Bureau of the Census, 1995b).

Based on the literature and associated rationale, I expect the following:

(I) Health Outcomes:

1) Native Americans will have poorer self-reported health than Whites.

2) Native Americans will be more likely to have no doctor visits per year than Whites.

3) Native Americans will have more activity limitations than Whites.

4) Native Americans spend more days in bed than Whites due to illness.

5) The racial gap in health between Native Americans and Whites narrows with age. That is, the gap is wider in younger ages and narrower in old ages as a result of selection.

6) Native Americans living in metropolitan areas will have better health outcomes than Native Americans living in non-metropolitan areas. That is, metropolitan Native Americans will have better self-reported health, fewer doctor visits, fewer activity-limited days, and fewer days staying in bed than non-metropolitan Native Americans. Furthermore, the racial differential in health between Native Americans and Whites in metropolitan areas in health will be smaller than that in non-metropolitan areas.

7) Socioeconomic status plays an important role in health differentials between Native Americans and Whites. The racial gap will be smaller or disappear between Native Americans and Whites after controlling SES factors.

(II) Mortality:

1) Native Americans will have a higher risk of death than Whites.

2) The racial gap in mortality between Native Americans and Whites will narrow with age. That is, the gap will be wider in younger ages and narrower in older ages as a result of selection.

3) Native Americans living in metropolitan areas will be less likely to die than Native Americans living in non-metropolitan areas. The racial differential in

mortality between Native Americans and Whites in metropolitan areas will be smaller than that in non-metropolitan areas.

4) Socioeconomic status will have a great impact on mortality differentials between Native Americans and Whites. When SES is held constant, the racial gap should be smaller or will disappear between Native Americans and Whites.

5) Health will be strongly related to mortality. People with more favorable levels of self-reported health, days in bed, doctor visits, and activity limitation will be less likely to die.

(III) Health Behavior:

1) Native Americans are more likely, compared to Whites, to have unhealthy behavior. That is, they are more likely to drink and smoke and they are less likely to perform leisure-time physical activity.

2) Healthy behaviors are positively associated with socioeconomic status and, thus, controlling for socioeconomic status will result in the reduction of health behavior gaps between Native Americans and Whites.

Study Aims

Few studies of racial differentials in health have focused on Native Americans as the main group of interest. In sum, the overall health outcomes of Native Americans have improved, but perhaps not as much as it appears. With longer life expectancy, health becomes more of a concern. Indeed, longevity does not necessarily mean additional healthy years. This leaves much room to explore

health indicators of the Native American population using high-quality, national-level data.

This dissertation attempts to fill these gaps. This study will investigate racial differences in adult health. The focus will be on the comparison of Native Americans and Whites aged 18 and above. What the differences are and why the differences exist between these two populations are two main questions to answer. In addition, the age effect on health and mortality will receive special attention, particularly in light of the two hypotheses revolving around age, race, and health that are currently prominent in the literature. Further, internal differences among Native Americans, particularly between those living in metropolitan and non-metropolitan areas, will be addressed. Because of data limitations, this study will use the metropolitan and non-metropolitan dichotomy as a proxy to explore differences between reservation and non-reservation Native Americans. While this measure is by no means a perfect proxy for reservation versus non-reservation residence, this dichotomy will shed light on the internal geographic differences among Native Americans in the U.S.

As the epidemiological trends change and the population structure differs, it is particularly important to document the health of Native Americans. As emphasized earlier, health is at least in part a social issue; the current racial gap in health is an especially important issue to explore so as to understand basic inequalities in society, especially between minority groups and the majority.

CHAPTER 2

LITERATURE REVIEW

This chapter includes two sections. The first section provides an introduction to the Native American population, including identification, geographic distribution, and socioeconomic profile. The second section reviews the health literature, consisting of mortality, morbidity and disability, and health determinants.

An Introduction to Native Americans

THE TERM "NATIVE AMERICAN"

Who are Native Americans? To whom does this term refer? Indeed, this is good evidence for the notion of the social construction of race, because the meaning of the term, and who identifies as a Native American, changes over time. Generally it denotes the descendants of the indigenous populations of North America that occupied the continent when European immigrants first arrived. This race/ethnic group consists of North American Indians, Eskimos, and Aleuts. The term of American Indians is often used interchangeably with Native Americans (Young, 1994).

Archeologists believe that the ancestors of Native Americans were nomadic Asian hunters entering North America through the Bering Strait during the last glacial period (about 15,000-35,000 years ago) (Champagne, 1994).

However, many Native Americans do not accept that theory. According to their oral traditions, some Native Americans believe that they are eastward migrants. For instance, the Lenape has an epic tradition of migration from the northwest to the Atlantic coast (Champagne, 1994). No matter where the ancestors of Native Americans came from, there is no doubt that they were the original inhabitants of America (Bureau of the Census, 1993). But their fate has been influenced dramatically by later migrants (i.e., European colonists), including the introduction of infectious diseases. In this work, I use the term Native American to refer to the American Indians, Eskimos, and Aleuts, excluding Native Hawaiians. And Native Americans and American Indians are used interchangeably.

IDENTIFICATION OF NATIVE AMERICANS

Recognizing the ambiguities of community recognition, the U.S. Congress has defined "Indians" as members of Indian tribes to simplify the tribal identification problem (Frey and McNickle, 1969), but no firm, consistent, and general definition has ever been implemented. Thus, the criteria, such as blood quantum, of being an Indian are diverse depending on various tribal constitutions developed after the Indian Reorganization Act of 1934 and subsequent decisions by the Indian Claims Commission (Thornton, 1987).

Self-identification is now common in defining the Indian population by many agencies of the federal government, including the Census Bureau, due to the

impossibility of developing an acceptable all-purpose administrative definition. That is, people are American Indian/Native American as long as they declare their race as American Indian/Native American (Snipp, 1989). Self-identification is used in the U.S. Census and in the health data set to be used here.

The primary advantage of self-identification is that there are virtually no prior assumptions about the concept of race. Unlike blood quantum definitions, there are no implicit or explicit genetic theories linked to racial self-identification. However, the main strength is also its major drawback. For social research, it is difficult to know what people really mean when they identify themselves as Native Americans (Snipp, 1989).

For example, self-identification greatly increased between 1970 and 1990, invoking a huge jump in the Indian population. As Table 1.2 shows, the Native American population increased to almost 1.5 million in 1980 from 0.8 million in 1970. This extraordinary growth could not have resulted from natural increase or immigration, but only from increasing self-identification (Passel, 1997). From 1980 to 1990, there was an additional 32.5% increase in the Native American population, with self-identification again found to be the driving factor (Eschbach, 1993). Between 1990 and 2000, an additional 26.3% increase was seen, to a total of 2,475,956 (Bureau of the Census, 2000b). A large number of Native Americans changed their self-identification partly because government policy provided benefits to persons identified as Native Americans, such as restitution of tribal

land (Eschbach, 1993), and partly because notions of Indian culture shifted from negative to sympathetic and romanticized in the 1960s (Eschbach et. al, 1998). Thus, many more persons who had not previously self-identified as Indians did so in the 1970s, 1980s, and 1990s (Passel, 1997).

NATIVE AMERICANS AS A RACE/ETHNIC GROUP

Van Den Berghe (1967:9) defines race as "a human group that defines itself or is defined by others as different from other groups by virtue of innate and immutable characteristics." In other words, a social definition is more relevant than physical characteristics (Frisbie and Bean, 1978). Thus, race is a social construct with limited biological significance (Cooper, 1984; Williams et. al, 1994; Frank, 2001). Viewing race as a primarily social category implies that health variation is not the consequences of genetics but of social factors, including socioeconomic status and cultural components (Cooper, 1984).

Cooper (1984) notes that the differentials between races can be ascribed only to social factors. In other words, racial differentials in health are the result of historical and economic conditions. Hence, health and mortality differentials issues should be discussed in this context (Hummer, 1996).

As a group, Native Americans have faced near genocide, population loss from disease, discrimination, physical separation from the majority population, and continued socioeconomic disadvantage (Jaimes, 1992; Stiffarm et. al., 1992). However, Native Americans are also internally heterogeneous; they live in

different geographic areas, speak different languages, and have different cultures (Young, 1994). Especially important is the distinction between Native Americans who live on reservations administered as distinct entities by the Bureau of Indian Affairs (BIA) and Native Americans who do not live on reservations.

GEOGRAPHIC DISTRIBUTION OF NATIVE AMERICANS

There are about 2.5 million Native Americans, which is about 1% of the total population in the U.S in 2000 (Bureau of the Census, 2000b). The 1990 census showed that 22% of Native Americans live on reservations and trust lands and about one-half of these live on the 10 largest reservations and trust lands, which are Navajo, Pine Ridge, Fort Apache, Gila River, Papago, Rosebud, Hopi, San Carlos, Zuni Pueblo, and Blackfeet. Almost one-half of Native Americans live in the West, 29% in the South, 16% in the Midwest, and 7% in the Northeast. This geographic distribution has not changed much in the recent decade (Bureau of the Census, 1993 & 2000a). More than one-half of Native Americans live in the following six states: Oklahoma, California, Arizona, New Mexico, Alaska, and Washington.

There are 314 reservations and trust lands in the United States. Note that trust lands are property associated with a particular American Indian reservation or tribe, held in trust by the Federal Government. “Reservation” also includes trust lands (Bureau of the Census, 1995b).

The Native American population has increasingly urbanized since the 1950s, and urbanization affects them profoundly (Thornton, 1987). Unlike other

minorities, urban Native Americans tend to live outside of central city areas (Snipp, 1997). Table 2.1 shows that the urban Native American population in the U.S. has been increasing since the turn of the twentieth century. This re-distribution was mainly caused by the urban relocation program, which was promoted by the Bureau of Indian Affairs (BIA), due to overpopulation on the reservations (Sorkin, 1978). The BIA relocation program provided adult vocational training, job placement, financial assistance, and counseling services. Even so, urbanized Native Americans still faced difficulties in adjusting to new communities, often have high secondary-school drop-out rates, and face job discrimination (Sorkin, 1978).

Table 2.1: The Percentage of Urban Native Americans in the U.S., 1890-1990

Year	Percentage
1890	0.0
1900	0.4
1910	4.5
1920	6.1
1930	9.9
1940	7.2
1950	13.4
1960	27.9
1970	44.5
1980	49.0
1990	56.7[a]

Source: citation from Thornton (1987: 227)
[a:] Source: Bureau of the Census, 1990

The urban-rural difference is, in part, a distinction between those living on reservations and those not living on reservations. Although it can be expected that the population on reservations decreases as the urban population increases, Table 2.2 shows that, while the proportion of Native Americans on reservations has decreased, the absolute number has increased. Note that the number in 1970 does

not include the Indians living on trust lands and reservations with less than 2,300 persons. Thus, at the very least, 26.9% of Native Americans lived on reservations in 1970. Hence, the reduction in the percentage of reservation residents is greater than the number shown in Table 2.2, at least for 1970-1980.

Table 2.2:
The Number and Percentage of Native Americans on Reservations, 1970-1990.

	Number	Percentage
1970	213,770[a]	26.9
1980	365,468[b]	24.7
1990	431,030[b]	22.3

Source: Bureau of the Census, 1970, 1980, and 1993)
[a] This number excludes that those people live on the reservations with 2,300 or more Indian population (Bureau of the Census, 1970).
[b] The 1980 and 1990 figures include those Indians living on reservations and trust lands. The previous years do not offer this information.

Note that 15.3% of Native Americans lived in Tribal Jurisdiction Statistical Areas (TJSA), Tribal Designated Statistical Areas (TDSA), and Alaska Native Village Statistical Areas (ANVSA) in 1990 (Bureau of the Census, 1993). If these tribal statistical areas are included in "reservation", then the reservation Native Americans would be about 38% of the total population. Note that TJSA, TDSA, and ANVSA were newly defined in the 1990 census (Snipp, 1997).

Is the MSA/Non-MSA dichotomy a good proxy of reservation/non-reservation? Let us take the 1990 census as an example. By this typology, 57% of Native Americans are counted as non-reservation Native Americans and 43% of Native Americans are counted as reservation Native Americans. The proxy, which

certainly not perfect, appears to be an acceptable one given that other alternatives are not possible when examining health and mortality at the national level.

SOCIAL AND ECONOMIC PROFILE

The socioeconomic (SES) profile of the Native American population as a whole is highly disadvantaged in the U.S. Without doubt, Native Americans' SES has improved over time in this country. For example, the college graduation rate went up from 7.4% in 1980 to 9.3% in 1990 (Bureau of the Census, 1980, 1990). Table 2.3, however, shows that there are continued gaps between Native Americans and the general population. Indeed, their median income is $13,475 lower and the high school and college graduate rates are about 10% lower than the general population.

Table 2.3: Selected Social and Economic Status Indicators of Native Americans Compared to the U.S. General Population in 1990.

Indicator	Native American	General Population
Median family income	21,750	35,225
% High School Graduates (25+)	65.5	75.2
% College Graduates (25+)	9.3	20.3

Source: Bureau of the Census, 1993.

In addition to income and education, Native Americans also have a different occupational distribution compared to the general population. Native Americans are more likely to work in low-paying occupational categories, such as

service, farming, forestry and fishing, precision production, craft, repair, operators, fabricators, and laborers (Table 2.4).

Table 2.4: Percent Distribution of Occupational Categories of Native Americans and the General Population in 1990

	Native American	Total population
Managerial and professional specialty	18.3	26.4
Technical, sales, and administrative support	26.8	31.7
Service	18.5	13.2
Farming, forestry, and fishing	3.3	2.5
Precision production, craft, and repair	13.7	11.3
Operators, fabricators, and laborers	19.4	14.9
Total	100.0	100.0

Source: Bureau of the Census, 1993

Native Americans are also a highly disadvantaged minority group in terms of political power and socioeconomic characteristics (Jaimes, 1992). It is further important to understand the health outcomes of this group, based on the recognition of their disadvantaged conditions. However, it is not enough to treat them as a homogeneous group; they are also internally diverse culturally and socioeconomically. Subgroups of Native Americans differ by their geographic distributions such as whether or not they live on reservations, as well as by education and income.

The social and economic diversity of this population in different residential areas is also significant. Generally, Native Americans residing on reservations are more socioeconomically disadvantaged. In other words, standards

of living on reservations are poorer while Indians living off reservations tend to live in better housing, suffer less unemployment, have better nutrition and improved sanitation than do their counterparts on the reservation (Thornton et. al., 1982).

For instance, the per capita income for Native Americans living on reservations and trust lands was $4,478 in 1989, while that for all Native Americans was $8,328 (Bureau of the Census, 1995b). More than one-half of Native Americans on reservations lived in poverty in 1989. Further, twenty percent of Native American housing units on reservations lacked complete plumbing facilities in 1990 (Bureau of the Census, 1993). Overall, 54% of Native Americans living on reservations are high school graduates or higher (Bureau of the Census, 1993) while 75% of total Native American adults are high school graduates or higher in 1990 (see Table 2.3). Finally, it is worth pointing out the characteristic of phonelessness in Indian society. About 53% of Native American homes on reservations did not have a phone in 1990 (Bureau of the Census, 1995b). Indeed, phone ownership is a significant socioeconomic indicator for American Indians for two reasons. First, having a phone is a sensitive socioeconomic indicator of basic standard of living. Note that this expenditure can be treated as a corollary of income and telephone ownership is an obvious indicator of consumption (Currie et. al. 1997). In most housing units without telephones, a telephone is an unaffordable luxury. Furthermore, families with

incomes below the poverty are far less likely to have phone services (Schement, 1995). Thus, telephone ownership mirrors the economic hardships among Native Americans.

Second, people without phone services may be less likely to use social resources. Without a doubt, a telephone represents functional membership in this information society (Schement, 1995). It has been used as an instrument of counseling and advising (Lester, 1977). It is also a tool for social services, including emergency help. If households lack telephone service, they may be impaired in regard to access to public assistance for which they qualify, and are particularly isolated in case of emergencies (Schement, 1995).

The Literature Review of Health

This section will provide a broad review of the health of Native Americans. Later, the section narrows to consider some of the outcome variables that will be considered in this work. Health determinants such as health behaviors will be presented at the end of this section. Note that some of the data presented in this section are based on the comparison of Native Americans and all races in the U.S., because a comparison between Native Americans and Whites is not always available.

MORTALITY

As mentioned in Chapter 1, the health of Native Americans has improved tremendously. Research has found that the current relative low death rates of Native Americans are attributable, in part, to the decline of infant mortality (Markides, 1983). Figure 2.1 shows the convergence of infant mortality over time between Native Americans and Whites. While there is still a difference, the magnitude is much smaller now than was the case in 1970.

As outlined by Young (1994, 1997), the health characteristics of Native Americans include the persistence of infectious diseases, the rise of chronic diseases, and the significance of social pathologies. It is true that the prevalence of infectious diseases has been reduced substantially; however, the threat from such diseases for Native Americans has not completely disappeared. Table 2.5 displays the decrease in tuberculosis mortality for Native Americans over time. While impressive, it also shows that the gap between Native Americans and Whites remains high. Indeed, the ratio in 1955 was 9.3 and was still 7.7 in 1993.

Figure 2.1: Infant Mortality Rates for Native Americans and Whites, 1973-1993

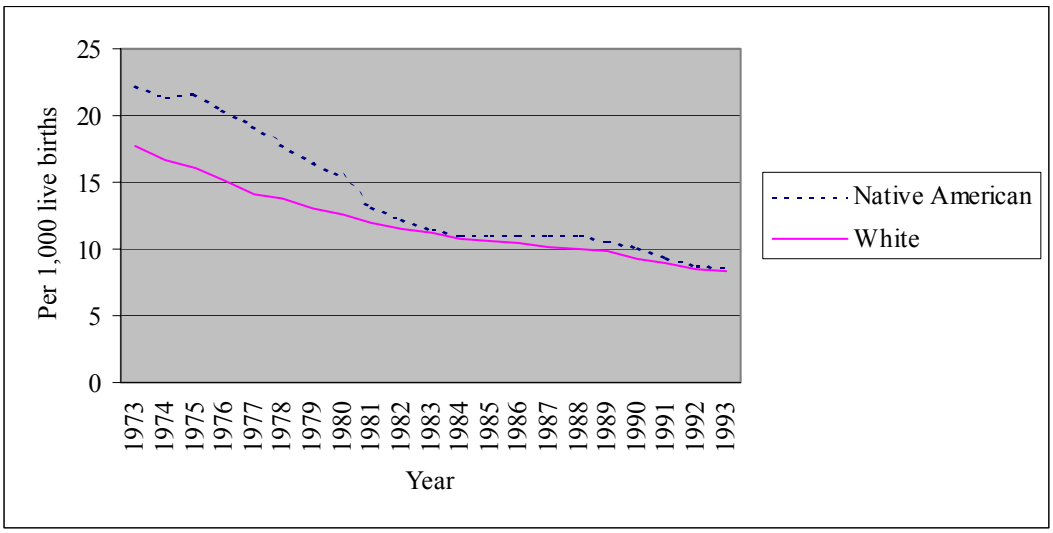


Table 2.5: Death Rate (per 100,000) by Tuberculosis from 1955 to 1993

	Native American	U.S. White	N.A./ White
1955	57.9	6.2	9.3
1973	10.5	1.1	9.5
1974	9.9	0.9	11.0
1975	9.6	0.9	12.0
1976	8.3	0.8	10.4
1977	7.2	0.7	10.3
1978	5.9	0.7	8.4
1979	5.3	0.4	13.3
1980	4.6	0.4	11.5
1981	3.8	0.4	9.5
1982	3.7	0.4	9.3
1983	2.9	0.3	9.7
1984	2.6	0.3	8.7
1985	2.3	0.3	7.7
1986	2.6	0.3	8.7
1987	2.8	0.3	9.3
1988	3.1	0.3	10.3
1989	2.9	0.3	9.7
1990	2.7	0.3	9.0
1991	2.2	0.3	7.3
1992	2.1	0.3	7.0
1993	2.3	0.3	7.7

Source: IHS, 1997.

Overall, Native Americans have higher mortality rates than Whites but the leading causes of death for these two populations are somewhat different. Cardiovascular disease is the leading cause of death for Native Americans, followed by malignant neoplasms, accidents, chronic liver disease and cirrhosis, diabetes mellitus, pneumonia and influenza, suicide, homicide, chronic obstructive pulmonary disease and allied conditions, tuberculosis, and AIDS in the 1990s (Table 2.6). This is not surprising because cardiovascular disease is the leading cause of death for all race groups in the U.S..

Table 2.6: Cause-Specific Death Rates for the U.S. by Race/Ethnicity

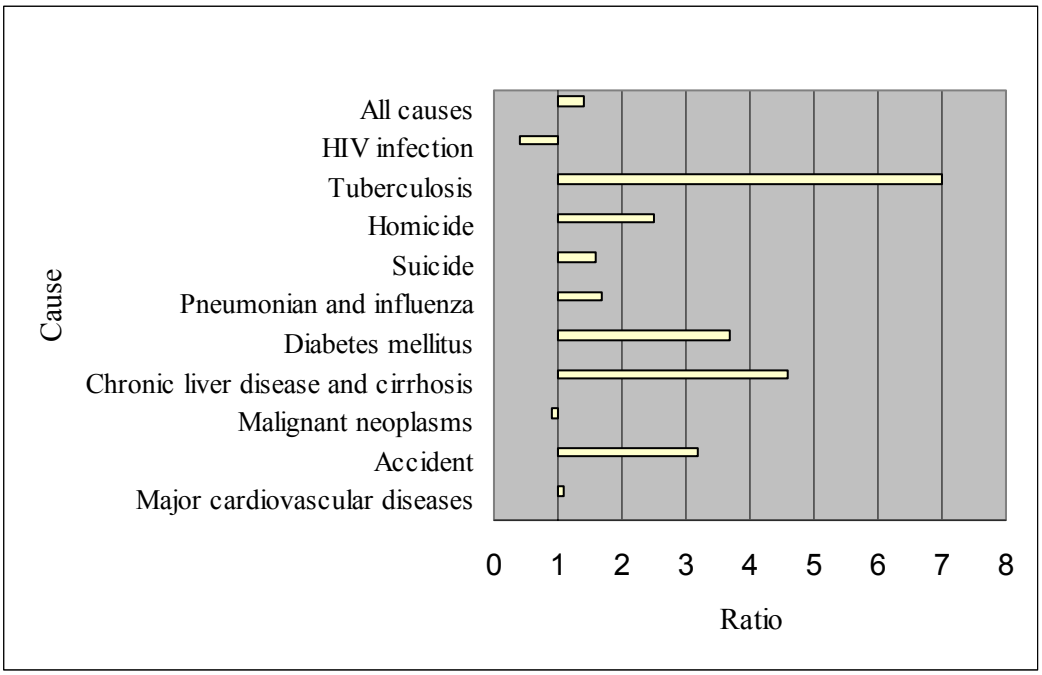
Cause of Death	Native American	U.S. White	N.A./ White
Major cardiovascular diseases	194.6	173.9	1.1
Accidents	94.5	29.6	3.2
Motor vehicle	53.3	16.1	3.3
All other	41.2	13.5	3.1
Malignant neoplasms	112.2	129.4	0.9
Chronic liver disease and cirrhosis	35.0	7.6	4.6
Diabetes mellitus	41.1	11.0	3.7
Pneumonia and influenza	21.7	12.9	1.7
Suicide	19.2	12.0	1.6
Homicide	15.1	6.0	2.5
Tuberculosis	2.3	0.3	7.7
Human immunodeficiency virus (HIV) infection	3.9	10.5	0.4
All causes	690.4	486.1	1.4

All rates are per 100,000.
Source: IHS, 1997.

Compared to Whites, several causes of death stand out, including accidents (motor vehicle and others), chronic liver disease and cirrhosis, diabetes mellitus, homicide, and tuberculosis. The ratios for these causes compared to Whites are all more than two, and as high as seven for tuberculosis. In other words, Native Americans experience excessive risk for most of causes listed in Table 2.6, with the exceptions of cancer and HIV.

Figure 2.2 portrays these patterns visually. Let us treat 1.0 as equivalence across groups. Thus, bars on the right of the crossing line indicate higher Native American risk. Only two are on the left. Note that cardiovascular disease is very close to 1.

Figure 2.2: Age-adjusted death rates: ratio of Native Americans to Whites



Source: IHS, 1997

The high mortality rate from accidents among Native Americans, especially motor vehicle accidents, is associated with a high reliance on automobiles, poor road conditions, unsafe vehicles, and a high level of alcohol use (Kunitz and Temkin-Greener, 1980).

Chronic liver disease and cirrhosis is considered to be an important behavior-related cause of death (Broudy and May, 1983; Li et. al., 1994). The etiology of death from cirrhosis of the liver strongly implicates chronic alcoholism (Broudy and May, 1983). The mortality gap from alcohol-related diseases between Native Americans and Whites narrowed from a seven-fold difference in 1970s to a four-fold difference in the 1990s (Young, 1994). But

again, this may be due, in part, to the changing self-identification of Native Americans.

Alcoholism is certainly a serious health problem for Native Americans (Broudy and May, 1983; Rhoades et. al, 1987). Not only is cirrhosis of the liver related to alcoholism, but some of the other problematic causes of death, such as homicide and suicide, are also associated with alcohol use to some degree (Levy and Kunitz, 1974). Of course, not all Native Americans drink. Indeed, some Native American populations have been found to have a lower prevalence of alcohol use than other populations (Imrie and Warren, 1988). For example, a large percentage of Navajos do not drink at all (Levy and Kunitz, 1974).

In sum, Native Americans have excess mortality rates in most leading causes compared to Whites with the exception of cancer and HIV/AIDS. The patterns of cause of death also differ by age and sex.

Table 2.7 reveals that the all-cause death ratios of Native Americans to Whites narrow as age goes up: 2.4 for ages 15-24, 2.2 for ages 25-44, 1.9 for ages 45-54, 1.5 for ages 55-64, and equivalence, or 1.0, for age 65 and above. Overall, for persons under 45 years old, automobile accidents, suicide, and homicide are leading causes. For persons aged 45 and over, heart disease and cancer are leading causes.

It is apparent that social pathologies play a major role in early adult death for Native Americans. The major causes of death for people aged 15-44 are

accidents, suicide, homicide, and chronic liver disease and cirrhosis. More than 80% of decedents aged 15-24 and more than 50% of decedents aged 25-44 die from social pathologies, causes of death that are preventable. The mortality rates of drinking-related causes for Native Americans aged 25-54 far outnumber those for their counterparts. Chronic diseases also play a major role in mortality for Native American adults. For example, a far greater percentage of middle-aged Native Americans die from diabetes than their White counterparts. And physical inactivity is one of the causes of diabetes among Native Americans (Manson et. al., 1992).

Mortality rates for Native Americans and Whites become more equal with age. Indeed, Native Americans who reach age 65 are less likely than Whites to die from heart disease, cancer and stroke.

Table 2.7: Five Leading Causes of Adult Deaths for Native Americans and Whites by Age, 1995

Cause of Death	Native American	U.S. White	N.A./ White
Age 15-24			
Accidents	112.0	40.2	2.8
Suicide	33.9	14.0	2.4
Homicide and legal invention	24.1	10.5	2.3
Diseases of the heart	4.3	2.2	2.0
Malignant neoplasms	3.8	4.6	0.8
All causes	196.5	84.3	2.3
Ages 25-44			
Accidents	118.2	32.3	3.7
Chronic liver disease and cirrhosis	35.9	4.9	7.3
Suicide	31.8	16.4	1.9
Diseases of the heart	25.5	17.7	1.4
Homicide and legal invention	24.1	7.5	3.2
All causes	364.4	165.5	2.2
Ages 45-54			
Diseases of the heart	182.6	100.4	1.8
Malignant neoplasms	130.7	135.4	1.0
Accidents	112.5	28.1	4.0
Chronic liver disease and cirrhosis	94.7	15.8	6.0
Diabetes mellitus	59.0	10.7	5.5
All causes	860.1	413.0	2.1
Age 55-64			
Diseases of the heart	439.2	303.9	1.4
Malignant neoplasms	364.5	404.7	0.9
Diabetes mellitus	167.7	32.6	5.1
Chronic liver disease and cirrhosis	115.0	24.5	4.7
Accidents	104.7	30.4	3.4
All causes	1617.5	1049.1	1.5
Age 65+			
Diseases of the heart	1502.3	1843.7	0.8
Malignant neoplasms	978.0	1129.4	0.9
Diabetes mellitus	354.0	122.5	2.9
Cerebrovascular diseases	353.1	410.0	0.9
Pneumonia and influenza	264.9	224.5	1.2
All causes	4842.2	5049.3	1.0

All rates are per 100,000 and adjusted for miscoding of Indian Race on death certificates. Source: IHS, 1999

One explanation for relative mortality equity among the old population is the selectivity mentioned earlier. Similarly, the frail individuals of the minority group may die out while the robust survive. Another explanation has to do with the undercount of Native American deaths. For example, the mortality for older Native Americans, as with infant mortality, is underestimated resulting from racial misclassification on death certificates (Hambright, 1968). Or as mentioned earlier, age misreporting may also lead to biased estimates (Preston et. al., 1996; Hummer, 2002).

Generally speaking, females have lower mortality than males. The death rates among male Native Americans are higher than female Native Americans for all causes (see Table 2.8). In particular, Indian men are two and half times more likely to die from accidents than Indian women.

Table 2.8: Cause-Specific Death Rates for Native Americans by Sex

Cause of Death	Male	Female	M/F
Major cardiovascular diseases	166.2	106.0	1.6
Accidents	127.8	50.9	2.5
Motor vehicle	67.1	33.5	2.0
All other	60.7	17.4	3.5
Malignant neoplasms	93.2	88.4	1.1
Chronic liver disease and cirrhosis	30.9	24.0	1.3
Diabetes mellitus	26.0	17.4	1.5
Pneumonia and influenza	24.6	19.6	1.3
Suicide	29.9	--	
All causes	716.3	511.5	1.4

All rates are per 100,000.
Source: IHS, 1997.
-- means data is not available.

OTHER HEALTH MEASURES

Unlike mortality, information on other health measures among Native Americans is rather scarce. But it is very important for understanding health patterns as life expectancy increases. Self-reported diseases, self-reported health, and disability will be reviewed here.

Young's book (1994), entitled The Health of Native Americans, provides the most thorough review of Native American health to date. A summary of this book will help in understanding the current health problems of Native Americans. This book mainly focuses on a discussion of three groups of diseases: infectious, chronic, and injuries and social pathologies.

For Native Americans[1], basically, infectious diseases are declining, but are persistent. One infectious disease that is particularly problematic is meningitis. For example, the age-adjusted relative risk of meningitis for Native Americans is four times higher than Whites in Alaska. Another serious disease for Native Americans is Hepatitis. There are five types of hepatitis-A to E. Hepatitis A is common for Native Americans. The incidence rate was 40 times that of Whites on South Dakota reservations during 1980-1985 (DHHS, 1990). The prevalence of hepatitis-B is 18% for children under five and increases with age (Schreeder et al., 1983). Thus, there are important infectious disease problems for Native Americans.

[1] Note that "Native American" here refers to the sampling population in the Survey of American Indians and Alaska Natives (SAIAN) representing American Indians and Alaska Natives living on or near Federal reservations and eligible to receive health care provided or supported by the Indian Health Service (Johnson and Taylor, 1991).

Chronic disease rates are rising for Native Americans, while infectious disease rates are declining. Hypertension, arthritis, diabetes, cardiovascular disease, and gallbladder disease are five of the most prevalent chronic diseases reported by Native Americans and all races in the U.S. Furthermore, Native Americans suffer from a higher burden of diabetes and gallbladder disease than the general population. The reported rates of rheumatism and arthritis are comparable for these two groups (Johnson et. al 1991).

Native Americans have had lower mortality rates for cancer compared to the total population in the U.S. over time. Heart disease and hypertension are not especially elevated for Native Americans, compared with the total population, either.

In contrast, diabetes, obesity, and gallbladder disease (GBD) are highly threatening diseases for Native Americans. Diabetes and obesity are often related; that is, a high prevalence of diabetes is often accompanied by a high prevalence of obesity. The prevalence of self-reported diabetes of Native Americans is higher than for the general population in the U.S. Meanwhile, Native Americans tend to have a larger percentage of overweight and obese persons than is the case in the general population. The prevalence of self-reported GBD among Native Americans is also higher than that among the general population.

As noted earlier, Native Americans are at higher risk for various kinds of injuries compared to the total population. But different age groups have different types of injury risks: motor vehicle accidents, drowning and firearm accidents are more common among young adults and falls and housefires are more common

among the elderly. Many of these problems are related to the disadvantaged social and economic conditions faced by Native Americans.

With respect to self-reported health, Native Americans are found to be more likely to report fair or poor health than are other race/ethnic groups (McGee et. al., 1999). For example, about 48% of Native American males self-report fair or poor health, while 30% of white males do (McGee et. al., 1999). Self-reported health is also found to be highly associated with both socioeconomic status and subsequent mortality (McGee et. al., 1999). Further, the percentage of persons reporting fair or poor health increases with age for all races, and the gap between Native Americans and Whites widens with age as well. This widening is consistent with the disability results of Hayward and Heron (1999) and counter to the reduced gap in mortality at older ages.

In general, mean days of restricted activity go up with age as well. Female Native Americans demonstrate this pattern. That is, the oldest age group of female Native Americans has the most days of restricted activity. For male Native Americans, however, restricted activity among the age group 45-64 is the highest (Young, 1994). The number of days of restricted activity is found to be related with age, education, and income (U.S. DHHS, Indian Health Conditions 1990).

HEALTH DIFFERENCES BETWEEN RESERVATION AND NON-RESERVATION NATIVE AMERICANS

It is important to address geographic differences in the health of Native Americans. Although Native Americans share common experiences as a group in

the U.S., they reside in different areas, have different historical experiences, and maintain different values, traditions, and lifestyles. All these have potential impacts on health. Nonetheless, data for specific tribes or culture areas are largely unavailable (Young, 1997). Thus, research on the health implications of reservation/non-reservation differences is very limited.

The reservation, non-reservation social context should differentially affect American Indian health in two respects: socioeconomic status and culture. The SES differentials between reservations and non-reservations have been pointed out earlier. Standards of living on the reservation are poorer. Native Americans living off the reservation tend to live in better housing, suffer from less unemployment, and have better nutrition and improved sanitation (Kenen & Hammerslough, 1985).

Native Americans on reservations tend to protect their cultural traditions and their religious beliefs partly because they feel less able to improve their economic position and partly because isolation on reservations reinforces the traditional culture. In contrast, Native Americans who migrate to the cities tend to be more optimistic about their futures. Note that although some Indian tribes have benefited from gaming, the majority of Native Americans do not benefit from it. Furthermore, most of the highly profitable casinos are close to large urban cities (King and Mclntire, 1998). Thus, urban Native Americans are more likely to participate in mainstream American life, including modern health care. The

persistence and strength of cultural ideas are directly related to whether they live on reservations or not. Behavioral differences and the material deprivation on reservations ought to be reflected in population health outcomes (Kenen & Hammerslough, 1985).

Among the limited research on health differences between reservation/non-reservation or urban/rural Native Americans, however, no consistent differences were found (Kington & Nickens, 2001). It was also found that there was no mortality differences between reservation and non-reservation Indians in 1970 (Klimas, 1982). Nonetheless, researchers often conclude that urban Native Americans have better health care, a lower incidence of most diseases, and lower mortality rates than rural Native Americans (Thornton, Sandefur, and Grasmick, 1982; Kenen and Hammerslough, 1985). In other words, urban Native Americans seem to be better off than rural Native Americans in terms of health.

Research further indicates that non-reservation death rates are sensitive to county poverty level, whereas reservation death rates are not. That is, non-reservation death rates are higher in the counties where more people are below the poverty line. This suggests that the subsidized health care on the reservations provides a "health safety net" which may be often underutilized and/or of minimal quality, but which is universal and serves all Native Americans regardless of the personal or family income level. Off the reservations, overall health care and

living conditions are better, but access to health care is determined by market factors (Kenen and Hammerslough, 1985).

HEALTH DETERMINANTS

Health Behavior

By and large, there are three groups of factors that may explain racial differentials in health: genetic factors, socioeconomic status, and cultural/behavioral factors (Frisbie and Bean, 1978; Hummer, 1996; Young, 1997). The focus of this section is on health risk behaviors.

Much research suggests significant differences across racial and ethnic groups for a range of health behaviors. Three health behaviors--alcohol intake, smoking, and physical activity--are important determinants of health and are reviewed below.

Drinking

The Native American population has been experiencing serious problems with alcohol. Among Native Americans, many are heavy drinkers, consuming five or more drinks during one episode (May, 1996). They also have high mortality rates from alcoholism. Table 2.9 exhibits the alcoholism death rates of Native Americans and Whites over two recent decades. This table refers to alcohol-involved deaths, like deaths from accidents, homicide, and suicide and alcohol-specific deaths including deaths from the following causes: alcohol

dependence syndrome, alcoholic psychoses, and chronic liver disease and cirrhosis specified as alcoholic (IHS, 1997; May, 1994). Note that alcohol is not the sole factor responsible for accident, suicide, and homicide deaths. However, they are ultimately alcohol-related to some degree (May, 1989).

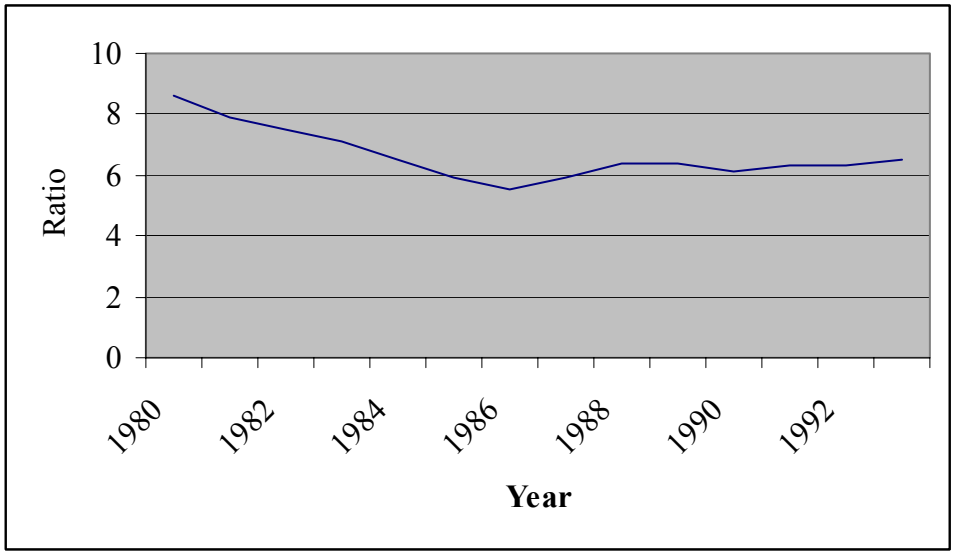
In 1980, the alcoholism mortality rate among Native Americans was 59.0, 8.6 times the rate for Whites. In 1993, the death rates from alcoholism decreased to 39.4 for Native Americans and 6.1 for Whites. The ratio also dropped down to 6.5. Figure 2.3 shows this gap, with just a slight decrease over recent years.

Table 2.9: Alcoholism Death Rate (per 100,000) from 1980 to 1993

	Native American	U.S. White	N.A./ White
1980	59.0	6.9	8.6
1981	52.4	6.6	7.9
1982	46.6	6.2	7.5
1983	42.6	6.0	7.1
1984	38.5	5.9	6.5
1985	34.4	5.8	5.9
1986	31.1	5.7	5.5
1987	34.1	5.8	5.9
1988	37.5	5.9	6.4
1989	39.4	6.2	6.4
1990	38.0	6.2	6.1
1991	37.9	6.0	6.3
1992	38.4	6.1	6.3
1993	39.4	6.1	6.5

Source: IHS, 1997.

Figure 2.3: Ratio of Alcohol-Related Death Rates, Native Americans to Whites, 1980-1993



Source: IHS, 1997.

The recent drinking patterns of Native Americans can be summarized as follows. First, Native Americans drink less, on average, than the general U.S. population. However, among those Native Americans who drink, there is a high prevalence of heavy drinkers, particularly binge drinkers. Second, urban Native Americans tend to have a higher prevalence of drinking compared to reservation Native Americans. Third, female Native Americans are less likely to drink than male Native Americans and furthermore, they are more likely than other U.S. women to abstain (May, 1996).

Overall, Native American drinking patterns compared to Whites and their relationship with SES and demographic characteristics need to be explored on a national scope.

Tobacco Use

Tobacco use has been an important part of the culture of many Native Americans; it is considered sacred and used during religious rituals and as traditional medicine (Pego et. al., 1995). However, it is also likely a major killer for Native Americans.

Among racial and ethnic groups in the U.S., rates of tobacco use are highest among American Indians. According to the Survey of American Indians and Alaska Natives (SAIAN) of the National Medical Expenditure Survey in 1987, 32.8% of IHS eligible individuals reported being current smokers (Lefknowitz and Underwood, 1991). National Health Interview Survey (NHIS) data reveals that the current smoking prevalence among Native Americans was 48.2% in 1978-1980 and declined to 39.2% in 1994-1995. The decline is primarily due to the reduction of male smokers in the early 1980s. However, both surveys raise concerns due to small sample sizes (DHHS, 1998). Note that the sample for SAIAN is IHS eligible while that for NHIS is self-identified Native Americans.

The tobacco use of Native Americans differs by sex. Male Native Americans tend to use smokeless tobacco (chewing tobacco and snuff) and Indian women have a higher prevalence of cigarette smoking than Indian men (DHHS, 1998; Kimball et. al, 1996). Further, studies have found that living on reservations

and having lower education are associated with use of smokeless tobacco (Kimball et. al., 1996; Spangler et. al., 1997a, 1997b).

Female Native Americans of reproductive age are found to be more likely to smoke than among their counterparts in other subgroups. The smoking prevalence rate among Indian mothers was 1.3 times higher than that among White mothers (Davis et. al, 1992).

Although more Native Americans than Whites smoke, they tend to smoke less than Whites. Compared with Whites smokers, Native American smokers smoke fewer cigarettes each day. About one-half of Native American smokers smoked fewer than 15 cigarettes per day in 1994-1995 (DHHS, 1998).

Not only is the prevalence of tobacco use among Native Americans higher than any other subgroup, but cessation rates are lower than among other subgroups. However, Native American smokers at older ages are more likely to quit smoking than their younger counterparts. That is, those aged 55 years and older have had the highest prevalence of cessation (DHHS, 1998).

As a matter of fact, cigarette smoking has been increasingly influencing the health of Native Americans. Death rates from malignant neoplasms of the respiratory system such as lung cancer increased for Native Americans from 1990 through 1995, though the rates are still lower than among Whites (Coultas et. al., 1992).

Physical Activity

The benefits of physical activity for health include the reduction of the risk of cardiovascular diseases and diabetes (DHHS, 1996; Manson et al., 1992). Diabetes has been a serious problem among Native Americans at least since World War II (Sievers and Fisher, 1985). Furthermore, Native Americans have a slightly higher likelihood of death from heart diseases compared to Whites (see earlier discussion). Native Americans are also less physically active than Whites at leisure time.

About 65% of Native Americans, compared to 56% for Whites, are found to have fewer than three 20-minute sessions of leisure-time physical activity per week. Leisure-time physical activity is also found to be inversely associated with level of education. That is, those with more schooling years are less likely to perform physical activity at leisure time (Morbidity and Mortality Weekly Report, 1994). People with a higher level of education may be better off financially; thus they can afford the time and cost of leisure-time physical activity. In addition to race/ethnicity and education, age, energy, neighborhood and scenery also influence physical activity. For example, older people in a neighborhood lacking hills and enjoyable scenery tend to be more inactive (King et. al., 2000).

More research on the physical activity patterns of Native Americans is necessary because little is known. For example, although Native Americans are more inactive physical at leisure time, they may also be more active in occupational physical activity (work-related physical activity), which also leads to better health (Hammermeister, 2001). In addition, analyses comparing rates of

physical activity across subgroups of Native Americans are not available (Kington and Nickens, 2001).

Access to Health Care and Utilization

The Indian Health Service (IHS) is the primary federal health care provider for Native Americans (IHS, 1997). Native Americans have been offered free-of-charge health care from the federal government since the early nineteenth century. In 1955, the IHS was removed from BIA jurisdiction and relocated as an agency within the Public Health Service, specifically the Department of Health and Human Services (DHHS) (IHS, 1997; Cunningham and Schur, 1991). Now, the IHS operates 37 hospitals, 60 health centers, 3 school health centers, 46 health stations and 34 urban Indian health centers (www.hhs.gov/agencies, last revised: August 28, 2002).

The IHS currently provides a wide range of curative and preventive health programs to approximately 1.5 million Native Americans (www.hhs.gov/agencies, last revised: August 28, 2002). Persons eligible for IHS are persons of Native American descent belonging to the community served by the local facilities and programs (Cunningham, 1993). About 60% of Native Americans are eligible.

In 1987, the National Medical Expenditures Survey (NMES) was used to obtain information about the eligible population. Results showed that 55% of Native Americans had no health insurance other than the IHS; 28.2% had private

insurance, most of it employment-related, and 16.9% had other public coverage. The private coverage rates are markedly lower than other groups of the U.S. population, in part reflecting their disadvantaged SES (Cunningham and Schur, 1991).

However, over 91% of those eligible for IHS services reported having a regular source of health care, compared to 81.6% of the general U.S. population (Cunningham, 1996). But the differences by place of residence are striking. Almost two-thirds of the eligible lived in non-MSA areas. While 63.2% of the eligible in MSA areas had a non-IHS regular source of care, this was the case for only 31.6 % in non-MSA areas (Cunningham, 1996).

To sum up, for the IHS eligible, persons with IHS and non-IHS health insurance have higher levels of health care use than do those who rely exclusively on the IHS. The IHS eligible in metropolitan areas with high income and other health coverage, especially private insurance, tend to have a non-IHS regular source of care.

The poor IHS eligible living in MSA areas can either utilize health programs intended for the general population such as Medicaid (but many of them are reluctant to do so) or make costly and time-consuming trips to their home reservation for the free health service provided by the IHS (Sorkin, 1978). Note that Medicaid is a Federal-State health insurance program for low-income and needy people such as the aged, blind, and/or disabled, and people who are eligible

to receive federally assisted income maintenance payments (http://www.hcfa.gov/medicaid/medicaid.htm).

How about the Native Americans who are not eligible for IHS? Who are they? The non-eligible include individuals who are not members of a federally recognized tribe, or who do not have close social and cultural ties with specific tribes and live outside of the major IHS service areas. Many of these persons live in large urban areas where IHS services traditionally have not been located (Cunningham, 1993). Thus, they are largely urban dwellers with little or no access to the IHS and with little or no connections with tribes. They may be middle income, acculturated to the mainstream society entirely, or they may be poor, struggling on the margins of urban society. When people, including Native Americans, are insured, they are more likely to use medical care (Spillman, 1992). Poor MSA/non-reservation Native Americans are more likely to be uninsured than their non-MSA/reservation counterparts and have weak ties to the tribes, lacking community support.

Summary

This chapter provides an introduction to Native Americans and a literature review of the health and mortality of Native Americans. I define Native Americans in terms of race/ethnicity based on a social construct. Native Americans are socioeconomically worse off than the general population. The majority of Native Americans live in urban areas. Urban Native Americans are

better off than non-urban Native Americans in terms of SES. Finally, the emergence of "new Native Americans" makes health analysis by place of residence very important.

In general, Native Americans have poorer health status and chances of survival than non-Hispanic Whites. Social pathologies account for a large proportion of the mortality gap between Native Americans and Whites. The prevalence of drinking and smoking and the lack of good exercise habits among Native Americans are also responsible for the health gap with Whites.

This dissertation will add to the body of knowledge of race/ethnic differences in health and mortality for the following reasons. First, it uses recent, nationally representative data to examine Native American health and mortality. Second, it relies on self-reporting of race. Third, it examines mortality, health, and health behavior using a single data set, providing more consistency than the most related studies. Fourth, it examines the influences of several SES factors. Finally, it compares MSA and non-MSA Native Americans.

CHAPTER 3

DATA, MEASURES, AND METHODS

This chapter includes three sections: data, measurement, and methods. The data sets to be used are discussed in the first subsection. The second subsection includes measurement schemes for the health outcomes, and the demographic and socioeconomic factors. The methods of analysis--logistic regression and piecewise constant rate models with non-proportional effects--are discussed in the third subsection.

Data

This study mainly employs data from the National Health Interview Survey (NHIS) conducted by the U.S. National Center for Health Statistics. The NHIS is an ongoing annual survey conducted every year since 1957, and collects health information, such as health status and health care utilization, from the civilian, non-institutionalized population in household interviews throughout the United States using a multistage sample. Thus, the sample of the NHIS excludes people in institutions like nursing homes and prisons (NCHS, 1993).

The NHIS is not a "simple random sample (not equal selection chance for all elements)." It is a complex survey involving random sampling, stratification, and clustering (Lohr, 1999). The NHIS sample is geographically clustered considering the interview cost--complete listings of clusters (e.g. counties) are available and cost little to fix the probability of including each member of the

population in the sample. Black and Hispanic persons are sampled at higher rates to assure adequate sample size. While it is a concern that Native Americans are not over-sampled in the NHIS, there are no larger data sets at the national level to analyze Native American health and mortality. The NHIS provides sample weight information to reflect national estimates.

I use different years of the NHIS in different portions of this dissertation. Thus, I discuss the stability and changes in the NHIS in the next several paragraphs.

Chapter 4.1 focuses on general health indicators including self-reported health, activity limitations, days in bed and doctor visits. To best accomplish this aim, I use data from the 1986-1994 pooled, core NHIS surveys (personal-level files) to obtain a sample size of Native Americans as large as possible. Note that the content and the sampling frame of the NHIS are consistent from 1986 through 1994. And only adults aged 18 and over are used for this analysis. The pooled NHIS data set from 1986-1994 contains 728,521 individuals aged 18 and above. The sample N for the purpose of the health analyses is 551,522, including 545,814 non-Hispanic Whites and 5,708 Native Americans.

The 1986-1994 NHIS are linked with the Multiple Cause of Death Public Use Data File (NHIS, 2000) for the mortality analysis (Chapter 4.2). This linked data set matches individuals aged 18 and above from 1986 to 1994 to the Multiple Cause Death (MCD) data file from 1986 to 1997 using the National Death Index (NDI). A probabilistic approach is used to classify the potential death matches on the basis of 12 criteria such as social security number, surname, and month and

year of birth. This linkage allows me to analyze mortality using the baseline data from the NHIS as covariates (e.g., Rogers, Hummer, and Nam, 2000). About three percent of the respondents from each NHIS have insufficient information to match with the MCD data file and are eliminated from the analysis, because the inclusion of those cases would be equivalent to the assumption they live forever (NHIS, 2000). After deletion of individuals who cannot possibly be linked to the NDI (about 3%) and cases with missing data (cases with missing income are retained), the N for mortality analysis is 527,974 for Whites and 5,352 for Native Americans. The number of deaths for non-Hispanic Whites is 42,379 and that for Native Americans is 359.

The sample adult data from 1997 to 2000 are combined to analyze health behavior (Chapter 4.3). The pooled data set yields 87,846 non-Hispanic Whites and 957 Native Americans. The sample adult files from 1997-2000 are used to analyze health behavior for two reasons. First of all, unlike the earlier versions of the NHIS, the sample adult files contain health behavior information. Secondly, the data are of high quality. The sample adult data are of higher quality than the person-level file because the former is in-person data while the latter is "proxy" data. Note that the person-level files contain information about all the family members reported only by one member.

The NHIS core questionnaire items are revised every 10-15 years; the last two major revisions occurred in 1982 and in 1997. Importantly, the core questionaire items of the 1982-1996 NHIS and the 1997-2000 NHIS are consistent, respectively. The 1982-1996 NHIS contains two parts: the core

questionnaire and supplements. Basic health and demographic information are included in the core questionnaire whereas data on particular health issues is collected in the supplements (NCHS, 2002).

Beginning 1997, the redesigned NHIS splits the core questionnaire into the family core, the sample adult core, and the sample child core. The family core obtains information from all family members and yields files such as personal-level files. From each family, one sample adult is randomly selected, and information on health status, health care services, and behavior is collected in the sample adult core file (NCHS, 2002).

With respect to the sampling design, the structures of the 1995-2004 NHIS and the 1985-1994 NHIS are similar, respectively (NCHS, 2002). However, the complex design must be taken into account when analyzing NHIS data. In this dissertation, SUDAAN is used to meet this aim.

Measures

DEPENDENT VARIABLES

The outcome variables used in this dissertation include general health indicators such as self-reported health, activity limitations, days in bed, and doctor visits; survival status; and health behaviors such as drinking, smoking, and physical activity.

General Health Indicators

Self-reported health is an excellent measure of health status because it is a simple and direct way of capturing individuals' health status (Idler and Benyamini, 1997). As a matter of fact, self-reported health was found to be a better predictor of subsequent survival than medical records (Mossey and Shapito, 1982). Self-reported health is a dynamic process, in that respondents evaluate their health by considering their overall physical conditions as they age. Thus, it even relates to the illnesses that a person have which might not have been diagnosed yet (Idler and Benyamini, 1997).

What is more, self-reported health has other implications. It might reflect a personal estimate of longevity by referring to his/her family health history (Idler and Kasl, 1991). In addition, it may affect subsequent health status (Idler and Benyamini, 1997). Further, research has found a strong relationship between self-reported health and mortality (Rogers et. al., 2000). That is, respondents who self-report their health as poor are more likely to die in a subsequent time period

compared to individuals who self report very good or excellent health. Thus, self-reported health has drawn significant attention from researchers in the U.S.

Self-reported health in the NHIS is a five-category measure, ranging from poor to excellent. Often, it is used in five categories to preserve the greatest detail (Idler and Benyamini, 1997). Other times, this variable is grouped into just two categories (poor and fair versus good, very good, and excellent), due to cell size restrictions (McGee et. al., 1999). The intent here is to preserve the five categories; however, cell size restrictions for some of the analyses force a collapsing of the five categories.

The other measurements of health include limitations of activity, days in bed, and doctor visits. The categorizations of these measures follow recent research (Frisbie, et. al., 2001). The original categories of limitation of activity comprise no limitation, limitation on other activities, limitation in major activities, and unable to perform major activities. Limitation on other activities and in major activities are lumped together as "somewhat limited" and unable to perform major activities are coded as extremely limited. Days in bed in the past year are provided in the NHIS as a continuous value, and are categorized into 0, 1-7, and more than 7 days. Note that being bed-ridden less than one week is considered as moderate illness while more than a week suggests a more serious illness. Likewise, the frequency of annual doctor visits is also divided into 0 (inadequate physician utilization), 1-2 (normal) and 3 and more (illness to some extent).

Survival Status

Survival status is coded for underlying cause of death in accordance with the International Classification of Diseases, Version 9 (U.S. DHHS, 1990). Four categories are distinguished: circulatory diseases (ICD 390-459), cancers (ICD 140-239), social pathologies, which includes external causes and cirrhosis of the liver (ICD 571 and ICD E800-E999), and a residual (all other causes). These causes are contrasted with survivorship across the follow-up period.

Health Behavior

This study focuses on three health behaviors: drinking, smoking, and physical activity. NHIS recoded alcohol into four categories: lifetime abstainer, former drinker, current drinker, and drinking status unknown. Lifetime abstainers refer to people with less than 12 drinks in their lifetime. Former drinkers refer to people with no drinks in the past year. People with one or more drinks in the past year are defined as current drinkers. The study further breaks current drinkers into heavy drinkers and light drinkers in order to understand drinking patterns in more detail. People who drink twice or more a week and have five or more drinks on average per week are defined as heavy drinkers. The remaining current drinkers are considered to be light drinkers.

Respondents are recoded in the NHIS as current smokers, former smokers, never smokers, and unknown status. Likewise, this study differentiates heavy

smokers from light smokers. Heavy smokers refer to those who smoke 15 or more cigarettes daily.

Less than two physical activities at least 20 minutes at leisure time per week are defined as 'leisure-time sedentary'. The NHIS has provided information on vigorous and moderate physical activity. The study chooses to use moderate physical activity. So, this variable is based on two questions: frequency moderate activity (times per week) and duration moderate activity (in minutes).

INDEPENDENT VARIABLES

The main independent variable in this dissertation is race/ethnicity as self-identified in the NHIS survey. "Native Americans" is used in a neutral sense here, and is identical with the term American Indians. It refers to all American Indians, Aleuts, and Eskimos. "Whites" in this paper refers to non-Hispanic Whites or Anglos. All other groups are excluded from this analysis.

Four other sets of independent variables--demographic, socioeconomic, geographic, and health--are incorporated in addition to race/ethnicity. The demographic variables include age, sex, and marital status. Age is treated continuously, yet it is also divided into three age groups: 18-44, 45-64, and 65+, to further test age effects. There are five categories of marital status in the NHIS, married, living with partners, never married, widowed, and divorced or separated. In this dissertation, they are further classified into two categories—married (the

reference) including those who are married or live with partners and unmarried including those who are in the remaining categories.

Socioeconomic status variables are composed of education, income, employment status, and telephone ownership. The level of education is divided into three categories: less than 12 schooling years, high school graduate, and 13 and more years (the reference). The income variable refers to annual family income in four categories: less than $10,000, $10,000-$19,999, $20,000-$34,999, $35,000 and above (the reference), and unknown. The unknown category is preserved because the deletion of it would lead to a large loss of cases.

Geographic variables comprise region and place of residence. The NHIS codes the regions as Northeast (the reference), Midwest, South, and West. Where such is evident, I have chosen the more advantaged category as the reference. As far as place of residence goes, since information based on reservation and non-reservation areas is not available in the NHIS, a proxy index of MSA (Metropolitan Statistical Area)/non-MSA is used. An MSA is defined as a county or a group of counties with at least 50,000 population and integrated with the central city economically and socially (NCHS, 1995).

Methods

Beyond descriptive analyses, two statistical methods are used in this study: logistic regression and piecewise constant exponential models with non-proportional effects.

LOGISTIC REGRESSION

This study endeavors to sustain the original categories of the dependent variables using multinomial logistic regression. However, most of the outcome variables are grouped into dichotomous categories due to the small differences between categories found in preliminary analyses. Multinomial and binomial logistic regression models are similar statistical methods. Basically, multinomial logistic regression is an extension of binomial logistic regression model (Hanushek and Jackson, 1977).

Binomial logistic regression is used when dependent variables are discrete and divided into two categories. The logistic regression model can be written as (Agresti, 1996):

$$\text{Logit}(p) = \alpha + \boldsymbol{\beta x}.$$

Where $\boldsymbol{x}$ represents a vector of independent variables and $\boldsymbol{\beta}$ denotes a vector of coefficients (Hanushek and Jackson, 1977). Note that the logistic transformation of the success probability p is:

$$\text{Logit}(p) = \log \frac{p}{1-p}.$$

The success probability p is in the form of

$$p = \frac{\exp(\alpha + \beta x)}{1 + \exp(\alpha + \beta x)}.$$

The component, $\frac{p}{1-p}$, is called odds (Agresti, 1996). Notice that while the terms of odds, relative risk, and rate ratio are interchangeable, the odds ratio is not. It is important to clarify the distinction of odds and odds ratio because they are used so often and they are often confused. The odds is defined as the relative probability of falling into one of two categories on some variable (Demaris, 1992). The definition of odds can be written as follows:

$$\frac{p}{1-p}$$

where p equals to the probability of success. If success is more likely than failure, the odds value will be greater than one (Agresti, 1996). For example, if the probability of success is 0.9, the probability of failure is 0.1, and the odds equals 0.9/0.1=9. That is, a success is 9 times as likely as a failure. A relative risk is a ratio of two probabilities (Agresti, 1996).

As pointed out, these differences are subtle and can be confusing. The odds or risk is written as a ratio of two probabilities: $\frac{p}{1-p}$ and the odds ratio is defined as the ratio of two odds (Agresti. 1996: 22). That is, the odds ratio is $\frac{\frac{p_1}{1-p_1}}{\frac{p_2}{1-p_2}}$. Agresti (1996) also demonstrates the relationship between the odds ratio and relative risk, where:

$$\text{odds ratio} = \frac{\frac{p_1}{1-p_1}}{\frac{p_2}{1-p_2}} = \text{relative risk} * \frac{1-p_1}{1-p_2}$$

Therefore, the odds ratio and relative risk take similar values as $\frac{1-p_1}{1-p_2}$ approaches to one (Agresti, 1996: 25-26). Again, odds, relative risk and rate ratio are interchangeable; however, the odds ratio is a distinct statistic.

Since the NHIS is drawn from a stratified sampling design, each person has a different probability of selection. SUDAAN, software incorporating a complex survey design, is employed to correct estimation errors. The tables herein report odds ratios, interpretable as the relative risk for one ethnic group compared with the reference ethnic group. In contrast to binomial logistic regression with dichotomous categories variables, the dependent variables of multinomial logistic regression are polytomous (Hanushek and Jackson, 1977), but interpretation remains the same.

Piecewise Constant Rate Models with Non-proportional Effects

The piecewise constant exponential model with non-proportional effects is used to analyze the mortality data because it allows for simple forms of time-dependent and non-proportional hazards.

The basic idea of this model is to split time into several periods and to assume that transition rates are constant within time intervals and allow hazards to change across intervals. For example, if there are N time periods, the piecewise constant transition rate is defined by N parameters. Suppose they are

$$T_1, T_2, T_3, \ldots, T_N;$$

Given these, the hazard rate from state *i* (origin) to state *j* (destination) is

$$r_{ij}(t)=\exp\{\beta_n^{(ij)}+\boldsymbol{x}^{(ij)}\boldsymbol{\beta}_n^{(ij)}\} \quad \text{if } T_n \leq t < T_{n+1}$$

$\beta_n^{(ij)}$ is a constant coefficient in time interval n, $\boldsymbol{x}^{(ij)}$ is a vector of covariates and $\boldsymbol{\beta}_n^{(ij)}$ is a vector of coefficients corresponding to these covariates (Powers and Xie, 2000).

In general, the number and length of the time intervals are arbitrarily defined, but there is some trade-off. If one chooses a large number of time periods, one will get a better approximation of the unknown baseline rate, but this implies a large number of coefficients to be estimated. On the other hand, if one chooses a small number of periods, there are fewer estimation problems, but there is probably a poorer approximation of the baseline rate. Therefore, in most cases, some compromise is needed (Blossfeld and Rohwer, 2002).

In the mortality analysis, I use the STATA statistical software package to fit the Poisson regression model. Poisson regression provides maximum likelihood estimates of exponential hazard rate models (the log likelihood differs by a constant that does not depend on parameters). Actually, the distribution functions of exponential and Poisson variables are similar (Powers and Xie, 2000). Poisson regression is used here mainly for the inclusion of complex survey weights. In this model, time is assumed to be exponentially distributed, and the event is assumed to be Poisson distributed.

The Cox proportional hazards model is most widely used in such mortality models because it can be applied in many situations; for example, when the shape

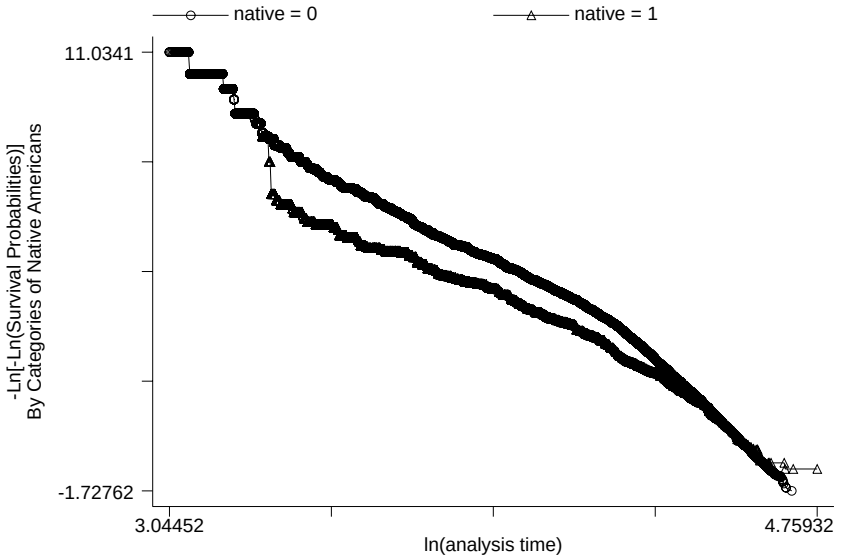
of time-dependence is little known or unknown, a specific parametric model is not strongly supported, or the magnitude and direction of the effects of the covariates, controlling for time-dependence, are the only concern. However, the proportional hazards model has one important assumption: the hazards rates are proportional over time. If the condition fails, the model will be inadequate (Blossfeld and Rohwer, 2002).

Figure 3.1 shows the graphical proportionality check. It plots –ln((-ln(survival probabilities)) for Native Americans and Whties versus ln(analysis time). These are often referred to as "log-log" plots (StataCorp, 1999: 417-423). A log-log survival curve is a transformation of an estimated survival curve. It results from taking logs of the survival function twice (StataCorp, 1999: 398). Note that the log of a probability is always a negative number. However, logs only take on positive numbers so it is necessary to negate the first log before taking the second.

Parallel plotted curves means that the proportional hazards assumption has not been violated and the non-parallel curves exhibit evidence against the proportionality assumption (StataCorp, 1999: 417-423). Apparently, as shown in Figure 3.1, the hazards of dying between Native Americans and non-Hispanic Whites are not constant over time/age. This examination result constrains me from using the Cox proportional hazard model to analyze Native American-White

mortality and suggest, instead, a piecewise constant rate model with non-proportional effects.

Figure 3.1: Proportionality Test Plot on Native Americans



Modeling Approach

The modeling strategy used in this dissertation is "progressive adjustment" (Mirowsky, 1999). The idea of progressive adjustment includes presenting an association and then demonstrating the reduction of the association by holding the explanatory variables constant. Following this strategy, this dissertation aims to show that health gaps exist between Native Americans and non-Hispanic Whites and that socioeconomic factors account for these gaps. So, the gaps between these two populations should vanish when controlling for SES. In addition, interaction modeling is also included in the analyses to find the moderators of health gaps.

Although there are different focuses in this dissertation, the modeling strategy for each purpose is essentially the same. I will start with the modeling of general health indicators.

There will be 4 models to examine the hypotheses for health outcomes. Hypotheses 1-4 state that Native Americans have worse health outcomes than Whites. To test these ideas, a logistic regression model is executed where race/ethnicity is the only variable. I expect to find a substantial difference between Native Americans and Whites. However, it is not sufficient to claim that Native Americans and non-Hispanic Whites are different in that way because these two populations are also different across some basic demographic dimensions. For example, Native Americans are younger than Whites, on average. Therefore, the basic population characteristics must be controlled to see the net differences between Native Americans and Whites. Hence, in addition to race/ethnicity, model 2 includes conventional demographic variables: age, sex and marital status. In light of the significance of residential areas for Native Americans, place of residence is also added in the model 2. These two models set the baseline difference in health between Native Americans and Whites. In other words, models 1 and 2 test the hypotheses 1-4. Model 3 will test hypothesis 7 by adding socioeconomic variables: individual-level education, family income, employment status, and whether the individual's household has a telephone. That

is, model 3 will show if the socioeconomic status variables help to explain the baseline health differences between groups.

As for hypothesis 6, the interaction term of race and place of residence is considered in model 4. The introduction of the interaction term shows the effect of race on health outcomes by place of residence. Note that the effect of race on health outcomes may depend on place of residence. The gap in health between Native Americans and Whites in metropolitan areas is expected to be smaller than that in non-metropolitan areas. Table 3.1 displays these four models. Since there are four dependent variables (self-reported health, days in bed, limitations of activity, and doctor visits), models contained in Table 3.1 are executed for each dependent variable. Note that for the outcome of limitations of activity, the health variables, self-reported health and days in bed, are taken into account as explanatory factors. And for the outcome of doctor visits, self-reported health, days in bed, and limitations of activity are included in the models as explanatory variables.

Table 3.1:
Models of Health Outcomes that Test the Hypotheses in This Dissertation

	Model 1	Model 2	Model 3	Model 4
Race/ethnicity	X	X	X	X
Other demographic variables		X	X	X
Geographic variables		X	X	X
SES			X	X
Race*Residence				X

Since age and place of residence are two important variables in this study, I focus on these two variables and run separate models as follows. For the age variable, three age groups--young-aged adults (18-44), middle-aged adults (45-64), and the elderly (65+)--are separated to further document the health differences between Native Americans and Whites within each age group. The models are run as shown in Table 3.2, respectively. With respect to geographic distribution, the same models are executed by metropolitan and non-metropolitan separately.

Table 3.2:
Models on Health Outcomes by Age and Place of Residence, Respectively

	Model 1	Model 2
Race/ethnicity	X	X
Other demographic variables		X
Geographic variables		X
SES		X

Another hypothesis regarding the place of residence is that Native Americans living in MSA areas have better health than Native Americans living in non-MSA areas. Since this is a comparison among Native Americans, models are run only for Native Americans. In other words, models in Table 3.2 are repeated for Native Americans; however, the reference group is MSA Native Americans instead of non-Hispanic Whites.

The models for mortality and health behaviors are similar to those for general health outcomes. The differences between health outcomes and mortality

is two-fold: 1) the unequal survival chance with age is considered so the odds ratios for each age group are reported for all four models, 2) all health outcomes are taken into account as independent variables. The difference between models for health outcomes and health behaviors is that the interaction term is not considered for the latter due to the different hypotheses spelled out for these different outcomes.

CHAPTER FOUR

STUDY RESULTS

This chapter is composed of three sections. The first section provides the study results for general health indicators, including self-reported health, days in bed, activity limitations, and doctor visits. The second section gives the results for mortality. The third reveals the findings on health behaviors. Since the data sets used are slightly different depending on the particular outcomes, each section begins with a descriptive analysis and then goes on with more complex statistical models.

4.1 General Health

DESCRIPTIVE RESULTS

Overall Population Characteristics

The overall characteristics for Native Americans and Whites displayed in Table 4.1.1 correspond well with past research. Data from the NHIS confirm that Native Americans are younger than Whites. The average age is 40.3 for Native Americans and 45.1 for Whites, respectively. The lower mean age is mirrored by the concentration of young people among Native Americans. Indeed, two-thirds of Native American adults are less than 45 years old, while the proportion for Whites is about ten percent less. The large percentage of Native Americans in the younger age group is due, in part, to Native American women's higher fertility

Table 4.1.1: Frequency Distribution of Selected Variables for Native American and non-Hispanic White Adults aged 18 and older, U.S., 1986-1994

	Native American		White	
Demographic Variables	N[a]	%[b]	N[a]	%[b]
Age (mean in years)	40.3		45.1	
Age 18-44	3712	66.0	293999	54.9
Age 45-64	1373	23.5	149743	27.0
Age 65+	623	10.5	102072	18.2
Sex				
Male	2639	46.9	257094	47.9
Female	3069	53.1	288720	52.1
Marital Status				
Married	3321	58.4	370768	67.5
Unmarried	2375	41.6	173954	32.5
Socioeconomic Variables				
Education in Years				
0-11 years	1917	33.4	100109	18.3
12 years	2164	39.0	214425	39.5
13+	1565	27.6	228008	42.3
Income (family)				
$0-$9,999	1280	22.1	46481	8.6
$10,000-$19,999	1329	23.0	84105	15.4
$20,000-$34,99	1225	22.3	126815	23.3
$35,000+	1088	19.2	201803	36.9
Unknown	786	13.5	86610	15.7
Employment Status				
Unemployed	370	7.1	14597	2.8
Not in Labor Force	2075	35.3	177928	32.1
Employed	3263	57.7	353289	65.1
Telephone				
Without phone	1285	21.8	18092	3.4
With phone	4393	78.2	524913	96.6
Geographic Variables				
Region				
Northeast	472	8.2	119434	21.9
Midwest	853	14.1	152911	27.3
South	1270	22.7	168382	31.8
West	3113	55.1	105087	19.1
Metropolitan				
MSA	3229	55.8	400872	75.1
Non-MSA	2479	44.2	144942	24.9
Total	**5708**	100	**545814**	100

Source: National Health Interview Survey 1986-1994
[a]: unweighted [b]: weighted

rate (Snipp, 1989).

Earlier research indicated that American Indian women are less likely to ever marry and more likely to get divorced than women in the general population (Sandefur and Liebler, 1996). Here, the pattern of marital status between Native Americans and Whites is similar. About 68 percent of Whites are either married or living with a partner while roughly 58 percent of Native Americans are married or living with a partner. Unlike Whites, who are spread out almost equally in all regions, Native Americans are concentrated in the West. Yet both groups tend to live in MSA areas, but with different concentrations: 75.1% for Whites and 55.8% for Native Americans. However, unlike other minorities, Native Americans do not have the tendency to live in the inner cities. Note that more than one-half of MSA Native Americans live in outside of the central city. This is partly because of their prior rural background (Snipp, 1989).

Not surprisingly, Native Americans are worse off than Whites in terms of socioeconomic status (SES). Of all non-Hispanic White adults, 42% have at least some college education while only about 28% of Native Americans have the same level of education. About 45 % of Native Americans have family income less than $20,000; however, only 24 % of Whites fall into such a category. The distributions of employment status and telephone ownership resemble those of education and income. The phoneless rate of Native Americans is about seven times that of Whites (21.8% for Native Americans and 3.4% for Whites). The unemployment rate for Native Americans is more than two times as high as that of Whites.

Table 4.1.2 shows the unadjusted percentages for various health status indicators for Native Americans and Whites. Native Americans are worse off than Whites for each health measure. Native Americans are more likely to report fair or poor health than Whites (18.4% versus 11.5%). The percentage of activity limited Native Americans is also higher than that of Whites (21.1% versus 17.9%). The difference for bed days between Native Americans and Whites is relatively small (13.8% versus 11.0% for seven or more days) compared to those

Table 4.1.2: Frequency Distribution of Health Variables for Native Americans and non-Hispanic White Adults aged 18 and older, U.S., 1986-1994

	Native American		White	
Health Variables	N[a]	%[b]	N[a]	%[b]
Self-reported Health				
Poor	1506	5.2	190288	3.3
Fair	1295	13.2	159071	8.2
Good	1801	31.3	130806	23.8
Very good	775	22.6	45383	29.2
Excellent	313	27.4	18487	35.1
Activity Limitation				
Extremely limited	511	8.5	28887	5.2
Somewhat limited	743	12.6	70196	12.7
Not limited	4453	78.9	446731	82.1
Days in Bed				
0 days	3048	53.3	305138	55.7
1-7 days	1795	32.0	177158	32.7
more than 7 days	812	13.8	59835	11.0
Doctor Visits				
0 visit	1635	29.1	130741	24.2
1-2 visits	1839	32.3	201884	37.0
3 visits or more	2234	38.7	213189	38.8
Total	**5708**	100	**545814**	100

Source: National Health Interview Survey 1986-1994
[a]: unweighted [b]: weighted

of self-reported health and activity limitation. The frequency of doctor visits does not favor either group, since one or two visits are treated as normal and the percentages of at least three visits for the two groups are rather close. However, the doctor visits distributions shows that Native Americans may underutilize physician services. About 29 % of Native Americans did not have a physician visit in the past year compared to 24 % for Whites**.**

Population Characteristics by Place of Residence

Because of the importance of place of residence in this work, Table 4.1.3 exhibits the distribution among Native Americans and Whites by MSA or non-MSA residence. People living in MSA areas tend to be younger than people living in non-MSA areas. However, the age difference by place of residence among Native Americans is smaller than that among Whites. Furthermore, the age difference between non-MSA Native Americans and non-MSA Whites (5.7 years) is one year more than that between MSA Native Americans and MSA Whites (4.7 years). Regarding marital status, non-MSA residents are more likely to either be married or be living with their partners than MSA residents. However, compared to their White counterparts, non-MSA Native Americans show a much lower percentage of being married (70.8% versus 59.7%) than MSA Native Americans (66.4% versus 57.3%). In short, compared with their White counterparts, non-

MSA Native Americans are relatively worse off than MSA Native Americans with respect to marital status.

As expected, MSA residents have a higher SES than non-MSA residents; however, the gap between MSA Native Americans and their White counterparts is not necessarily smaller when compared to non-MSA Native Americans and their counterparts. For example, the education gap between MSA Native Americans and MSA Whites is larger than that between non-MSA Native Americans and non-MSA Whites. Indeed, the percentage with less than 12 years of schooling for MSA Native Americans (31.7%) is double that of Whites (16.3%), while those for non-MSA Native Americans and Whites are 35.7% and 24.3%, respectively. Non-MSA Native Americans also have a much larger proportion with annual income less than $10,000 compared to non-MSA Whites (27.3% versus 12.6%), while the levels for MSA Native Americans and MSA Whites (18.0% versus 7.3%) are lower. However, the difference in the proportion with high income (more than $35,000 annually) between MSA Whites and MSA Native Americans (16.9%) is larger than that between non-MSA Whites and non-MSA Native Americans (11.3%). MSA Native Americans are better off than non-MSA Native Americans in terms of income; however compared with their White counterparts, MSA Native Americans do not enjoy the same advantage. The smaller unemployment rate for MSA residents of both racial groups may reflect better job opportunities in urban areas. The racial difference in phone ownership in non-MSA areas is far

Table 4.1.3: Frequency Distribution of Selected Variables for Native American and non-Hispanic White Adults aged 18 and older, U.S., 1986-1994

	Native American		White	
	MSA	Non-MSA	MSA	Non-MSA
Demographic Variables				
Age (mean in years)	40.0	40.6	44.7	46.3
Age 18-44	67.0	64.8	55.9	51.8
Age 45-64	22.7	24.5	26.7	27.6
Age 65+	10.3	10.7	17.4	20.5
Sex				
Male	47.3	46.3	47.9	48.1
Female	52.7	53.8	52.1	51.9
Marital Status				
Married	57.3	59.9	66.5	70.8
Unmarried	42.7	40.1	33.6	29.2
Socioeconomic Variables				
Education in Years				
0-11 years	31.7	35.7	16.3	24.3
12 years	36.1	41.4	38.1	43.6
13+	31.3	23.0	45.6	32.1
Income (family)				
$0-$9,999	18.0	27.3	7.3	12.6
$10,000-$19,999	22.1	24.0	14.0	19.8
$20,000-$34,99	21.7	22.9	22.6	25.6
$35,000+	24.3	12.8	41.2	24.1
Unknown	13.8	13.1	15.0	17.9
Employment Status				
Unemployed	6.2	8.2	2.7	3.0
Not in Labor Force	32.9	38.3	31.1	35.3
Employed	61.0	53.5	66.2	61.7
Telephone				
Without phone	10.9	35.5	2.7	5.6
With phone	89.1	64.5	97.3	94.4
Geographic Variables				
Region				
Northeast	13.0	2.1	25.1	12.2
Midwest	15.1	12.8	25.2	33.3
South	29.2	14.4	28.8	40.6
West	42.7	70.7	20.9	13.9
Total	**3229**	**2479**	**400872**	**144942**

Source: National Health Interview Survey 1986-1994

greater than that in MSA areas: indeed, 35.5% of non-MSA Native Americans do not have a telephone in the household while only 5.6% of their White counterparts

in non-MSA areas do not have a phone in the household. Finally, a large majority of non-MSA Native Americans live in the West (70.7%), consistent with the distribution of reservations. While MSA Native Americans are also more likely to reside in the West (42.7%), they are also much more geographically dispersed. In all, both non-MSA and MSA Native Americans are disadvantaged compared to Whites. However, larger gaps are observed between MSA Native Americans and MSA Whites.

Table 4.1.4 shows the health distributions by race and place of residence. Among Whites, the health patterns are very consistent: non-MSA residents are more likely to report poor or fair health, have an activity limitation, and stay in bed for more than 7 days than MSA residents. However, for Native Americans, those who live in the non-MSA areas are not always worse off. For example, 19.3% of non-MSA Native Americans have some kind of activity limitation in comparison to 22.6% of MSA Native Americans. In addition, MSA Native Americans are more likely to stay in bed for more than 7 days than non-MSA Native Americans (14.5% versus 12.9%). In sum, then, MSA/non-MSA health differences are not clearly consistent for Native Americans.

Table 4.1.4: Frequency Distribution of Health Variables for Native Americans and non-Hispanic Whites

	Native American		White	
	MSA	Non-MSA	MSA	Non-MSA
Health Variables				
Self-reported Health				
Poor, fair	17.7	19.5	10.5	14.7
Good, very good, excellent	82.4	80.5	89.5	85.4
Activity Limitation				
Extremely limited	9.1	7.8	4.8	6.4
Somewhat limited	13.5	11.5	12.1	14.4
Not limited	77.5	80.7	83.0	79.2
Days in Bed				
0 day	51.6	55.5	54.8	58.5
1-7 days	33.1	30.7	33.7	29.4
more than 7 days	14.5	12.9	10.8	11.4
Doctor Visits				
0 visit	27.8	30.6	23.6	25.8
1-2 visits	32.9	31.5	37.3	36.1
3+ visits	39.3	37.9	39.1	38.1
Total	**3229**	**2479**	**400872**	**144942**

SOURCE: NATIONAL HEALTH INTERVIEW SURVEY 1986-1994

RACIAL DIFFERENCE IN HEALTH: DEMOGRAPHIC, SOCIOECONOMIC, AND GEOGRAPHIC EFFECTS

Self-reported Health

Table 4.1.5 demonstrates the results of four binomial logistic regression models of self-reported health (poor or fair versus good, very good, or excellent). Model 1 is the baseline model, consisting only of race/ethnicity; demographic variables are added in model 2. In addition to demographic variables, model 3 includes the complete set of SES variables. Model 4 considers a two-factor interaction term that tests whether Native American health differs by MSA/non-MSA residence. Recall that these models test the following hypotheses. First, Native Americans are worse off than Whites in terms of self-reported health. Secondly, controlling socioeconomic factors explains the health gap. And, third, Native American health differs according to MSA/non-MSA residence.

The unadjusted odds ratio of Native Americans versus Whites for self-reported health is 1.73, meaning that Native Americans are 73 % more likely to report poor or fair health than Whites (see model 1). The increase of the odds ratio in model 2 is partly explained by a healthier demographic profile of Native Americans compared with Whites, such as their younger age structure. This is important in that the race differential is larger than the bivariate relationship indicates. That is, holding constant demographic characteristics, Native Americans are 127% more likely to report poor or fair health than Whites. Here,

Table 4.1.5: Logistic Regression Results of Demographic, Socioeconomic, and Geographic Factors on Self-reported Health

	Model 1	Model 2	Model 3	Model 4
Demographic Variables				
Race/Ethnicity [Non-Hispanic White]				
Native American	1.73***	2.27***	1.41***	1.61***
Age		1.05***	1.02***	1.02***
Male [Female]		0.99	1.19***	1.19***
Marital Status [Married]				
Unmarried		1.18***	0.87***	0.87***
Geographic Variables				
Region of Residence [Northeast]				
Midwest		1.09*	1.10***	1.10**
South		1.56***	1.50***	1.50***
West		1.09**	1.23***	1.23***
Type of Residence [MSA]				
Non-MSA		1.31***	1.06*	1.06*
Socioeconomic Variables				
Education [13+ schooling years]				
0-11			2.63***	2.62***
12			1.53***	1.53***
Income [$35,000+]				
$0-$9,999			2.88***	2.88***
$10,000-$19,999			2.04***	2.04***
$20,000-$34,999			1.45***	1.45***
Unknown			1.64***	1.64***
Employment Status [Employed]				
Unemployed			1.63***	1.63***
Not in Labor Force			2.68***	2.68***
Phone Ownership [with phone]				
Without Phone			1.39***	1.40***
Interaction terms				
Native American*Non-MSA				0.75***
Intercept	-2.03***	-4.65***	-4.87***	-4.87***
-2LL	227.09	41737.83	69024.00	69056.09

***: p<0.01, **: p<0.05, *: p<0.10
[]: Categories in brackets are the reference groups.
Source: National Health Interview Survey 1986-1994

unmarried people (including those who are single, divorced, separated, or widowed) are 18% more likely to report poor or fair health than individuals who are either living with their husbands or partners. Individuals living in southern areas are more likely to report poor or fair health than individuals living in other areas. Non-MSA residents are 31% more likely to report poor or fair health compared to MSA residents.

When controlling for SES variables in addition to the demographic factors, the odds ratio for Native Americans goes down from 2.27 to 1.41, which is a substantial decline due to adjustment for the disadvantaged SES of Native Americans. Thus, SES, in large part, accounts for the gap of self-reported health between groups, which is consistent with the socioeconomic hypothesis. In addition, the reduction of the effects of marital status (from 1.18 to 0.87) and place of residence (from 1.31 to 1.06) in model 3 indicate that what seemed to be a beneficial effect on being married and living in MSA areas is largely due to variation in SES. Here, all the SES factors show a strong association with the odds of reporting poor or fair health. As a matter of fact, individuals with disadvantaged SES such as lower levels of education and income, and being unemployed have a higher likelihood of reporting poor or fair health compared to their more educated, affluent and working counterparts. Among SES factors, lack of phone ownership also shows a moderate association with poor or fair self-reported health. Note that the association of SES and health is two-way: 1) SES

influences health; 2) poor health results in poor SES. Although what is shown here is the former, the second association is also plausible and cannot be ignored (Adler and Ostrove, 1999).

Model 4 additionally includes the interaction term of race and place of residence. The odds ratio (1.61) for race now represents the gap in self-reported health between MSA Native Americans and MSA Whites. Very surprisingly, the odds ratio of the interaction term is significantly below one (0.75). The significant product term here shows that the effect of being Native American on self-reported health depends on the place of residence. Indeed, the health gap between Native Americans and Whites is larger in metropolitan areas and smaller in non-metropolitan areas. This is inconsistent with what was hypothesized. The effect of place of residence is examined in greater depth in a later section.

Activity Limitations

Recall that Native Americans are hypothesized to have more activity limitations than Whites and that socioeconomic variables will play a major role in the activity limitation gap. Further, the Native American-White activity limitation gap is expected to be larger in non-MSA areas. The four models in Table 4.1.6 are used to test these hypotheses.

The pattern for activity limitations between Native Americans and Whites is very similar to that of self-reported health. The odds ratio of 1.22 from the baseline model in Table 4.1.6 shows the higher likelihood of having an activity

Table 4.1.6:
Logistic Regression Results of Demographic, Socioeconomic, and Geographic Factors on Activity Limitations

	Model 1	Model 2	Model 3	Model 4
Demographic Variables				
Race/Ethnicity [Non-Hispanic White]				
Native American	1.22***	1.40***	1.03	1.30***
Age		1.04***	1.03***	1.03***
Male [Female]		1.05***	1.26***	1.26***
Marital Status [Married]				
Unmarried		1.51***	1.21***	1.21***
Geographic Variables				
Region of Residence [Northeast]				
Midwest		1.13***	1.14***	1.14***
South		1.32***	1.28***	1.28***
West		1.27***	1.34***	1.34***
Type of Residence [MSA]				
Non-MSA		1.20***	1.05*	1.06**
Socioeconomic Variables				
Education [13+ schooling years]				
0-11			1.45***	1.45***
12			1.09***	1.09***
Income [$35,000+]				
$0-$9,999			2.10***	2.10***
$10,000-$19,999			1.58***	1.58***
$20,000-$34,999			1.25***	1.25***
Unknown			1.14***	1.14***
Employment Status [Employed]				
Unemployed			1.59***	1.59***
Not in Labor Force			2.63***	2.64***
Phone Ownership [with phone]				
Without Phone			1.17***	1.18***
Interaction terms				
Native American*Non-Msa				0.59***
Intercept	-1.52***	-3.96***	-3.91***	-3.91***
-2LL	37.10	50145.97	71323.61	71379.04

***: p<0.01, **: p<0.05, *: p<0.10
[]: Categories in brackets are the reference groups.
Source: National Health Interview Survey 1986-1994

limitation among Native Americans compared to Whites. Controlling for demographic variables in model 2, the odds ratio goes up to 1.40, again indicating that Native Americans have a healthier demographic profile. Males, unmarried individuals, people living in the areas other than Northeast and non-MSA residents are worse off in terms of activity limitations.

In model 3, which adjusts for demographic and socioeconomic status variables, the odds ratio for race/ethnicity drops to 1.03 and is no longer significant. Thus, Native American-White differences in activity limitations are completely mediated by socioeconomic factors. Clearly, people with higher SES (educated, high income, employed) are less likely to have activity limitations. As with self-reported health, the effects of being unmarried and living in a non-MSA area also decrease when SES is controlled. The phoneless effect on physical activity limitations (the odds ratio is 1.17) is not as strong as that on self-reported health, probably because phone ownership is more an indicator of isolation in addition to its SES implication. Although not examined here, the reciprocal effect of SES is possible. That is, people with physical disability are more likely to unemployed and have lower income. The significant interaction term in Model 4 shows that the effect of being Native American on activity limitations is associated with place of residence. And like the pattern for self-reported health, living in non-MSA areas reduces the likelihood of activity limitation, relative to Whites, for Native Americans.

Bed Days

The hypotheses to be examined in this section include: Native Americans spend more days in bed than Whites due to illness and the gap between the two racial groups is due to SES factors.

The unadjusted odds ratio of race/ethnicity in the baseline model shows that Native Americans are 30% more likely to stay in bed for more than 7 days compared to Whites (Table 4.1.7). When the demographic and geographic factors are controlled, the adjusted odds ratio slightly increases from 1.30 in model 1 to 1.33 in model 2. Note that males are 30% less likely to be bed-ridden for more than a week compared to females. Place of residence is not associated with bed days.

The effect of being Native Americans loses significance in model 3, suggesting that SES is the underling reason for the racial difference in bed days. Here, phone ownership has no significant effect. Model 4 additionally includes self-reported health and activity limitations, which show strong and significant effects. Individuals reporting poor or fair health or having activity limitations are much more likely to stay in bed for one week or more compared to those who report good, very good, or excellent health or have no activity limitations, respectively. Controlling for health variables also weakens the effects of SES suggesting that the reciprocal causation of SES on health. An additional model included an interaction term (Native American by MSA/non-MSA residence) to test whether the race gap in health differed by residence. However, the product

Table 4.1.7: Logistic Regression Results of Demographic, Socioeconomic, and Geographic Factors on Bed Days (0-7 versus more than 7 days)

	Model 1	Model 2	Model 3	Model 4
Demographic Variables				
Race/Ethnicity [Non-Hispanic White]				
Native American	1.30***	1.33***	1.02	0.95
Age		1.01***	1.00***	0.99***
Male [Female]		0.70***	0.79***	0.69***
Marital Status [Married]				
Unmarried		1.23***	1.02*	0.98
Geographic Variables				
Region of Residence [Northeast]				
Midwest		0.98	0.97*	0.92***
South		1.19***	1.14***	1.00
West		1.12***	1.14***	1.05*
Type of Residence [MSA]				
Non-MSA		1.04	0.92*	0.89***
Socioeconomic Variables				
Education [13+ schooling years]				
0-11			1.37***	1.02
12			1.07***	0.99
Income [$35,000+]				
$0-$9,999			1.82***	1.26***
$10,000-$19,999			1.42***	1.14***
$20,000-$34,999			1.18***	1.09***
Unknown			1.17***	1.05***
Employment Status [Employed]				
Unemployed			1.54***	1.37***
Not in Labor Force			1.99***	1.33***
Phone Ownership [with phone]				
Without Phone			1.16	1.08***
Health Variables				
Self-reported health [Good, very good, excellent]				
Poor or Fair				3.81***
Activity Limitation [No]				
Yes				4.05***
Intercept	-2.03***	-2.67***	-2.64***	-2.20***
-2LL	46.89	6906.38	16508.32	59736.41

***: p<0.01, **: p<0.05, *: p<0.1

[]: Categories in brackets are the reference groups.

Note that model 5 is dropped because the insignificance of the interaction term.

Source: National Health Interview Survey 1986-1994

term was insignificant, so the model is not shown. The insignificant interaction means that the effect of race/ethnicity does not differ by place of residence.

Physician Utilization

The hypotheses for physician utilization to be tested in this section are: 1) Native Americans are more likely to have no doctor visits compared to Whites, and 2) SES accounts for this difference.

As discussed in the descriptive analysis (see Table 4.1.2), the probability of having three or more doctor visits for Native Americans is almost equal to that for Whites. However, Native Americans are more likely to have no doctor visits than Whites. Table 4.1.8 presents the binary logistic regression analysis of physician utilization, with 0 visits compared to at least one visit (the reference category).

As expected, regardless of sociodemographic variables, the probability of no physician visits in the past year for Native Americans is higher than that for Whites. Model 1 shows that Native Americans are 28% more likely to have no visits than Whites. The odds ratio drops to 1.20 when demographic variables are controlled (model 2). Model 2 also shows that males are less likely to visit physicians than females, with the likelihood of no doctor visits for males 117% higher than females. This is consistent with the fact that females report more illness than males. And this gender effect remains large even when SES and

Table 4.1.8: Logistic Regression Results of Demographic, Socioeconomic, and Geographic Factors on Doctor Visits (0 times versus 1 time or more)

	Model 1	Model 2	Model 3	Model 4
Demographic Variables				
Race/Ethnicity [Non-Hispanic White]				
Native American	1.28***	1.20***	1.11***	1.11**
Age		0.99***	0.99***	0.99***
Male [Female]		2.17***	2.07***	2.13***
Marital Status [Married]				
Unmarried		1.09***	1.10***	1.12***
Geographic Variables				
Region of Residence [Northeast]				
Midwest		1.02	1.01	1.03**
South		1.05**	1.03	1.07***
West		0.99	1.02	1.06***
Type of Residence [MSA]				
Non-MSA		1.15***	1.09***	1.09***
Socioeconomic Variables				
Education [13+ schooling years]				
0-11			1.37***	1.56***
12			1.31***	1.35***
Income [$35,000+]				
$0-$9,999			1.01	1.21***
$10,000-$19,999			1.13***	1.23***
$20,000-$34,999			1.07***	1.11***
Unknown			1.32***	1.35***
Employment Status [Employed]				
Unemployed			1.00	1.07***
Not in Labor Force			0.68***	0.82***
Phone Ownership [with phone]				
Without Phone			1.35***	1.43***
Health Variables				
Self-reported health [Good, very good, excellent]				
Poor or Fair				0.65***
Activity Limitation [No]				
Yes				0.44***
Bed Days [<= 7 days]				
More than 7 Days				0.22***
Intercept	-1.14***	-1.06***	-1.30***	-1.39***
-2LL	70.44	21149.91	25875.82	48840.56

***: p<0.01, **: p<0.05, *: p<0.10
[]: Categories in brackets are the reference groups.
Note that model 5 is dropped because the insignificance of the interaction term.
Source: National Health Interview Survey 1986-1994

health status are controlled. Note that the effect of sex drops only by 10% in model 3.

Socioeconomic differences in physician visits are observed in model 3, with use positively related to income, education, and phone ownership. Note that phone ownership has a moderately strong relationship with doctor visits, with the phoneless 35% more likely to have no visits than those people with a phone in their households (see model 3). This may because that people with no phone are much more isolated. Finally, doctor visits are inversely associated with health status (see model 4). Those who report fair or poor health, have an activity limitation, and stay in bed for at least 7 days in the past year are less likely to have no doctor visits compared to their more healthy counterparts. Holding the need for physician utilization constant, Native Americans are still more likely to have no physician visits than Whites. The effects of SES in model 4 is even become stronger, indicating that SES factors play an important role for access to physicians.

Age Effects

An important hypothesis detailed above is that the health gap between Native Americans and Whites narrows with age. In other words, the racial gap is smaller for the elderly, which is what would be consistent with published mortality rates for Native Americans and Whites.

Table 4.1.9: Odds Ratios for Race Differences in Health by Age, U.S. Adults

		Self-reported Health		Activity Limitation	
		Model 1	Model 2	Model 1	Model 2
18-44	N.A. versus White	2.51***	1.25***	1.52***	0.92
	-2LL	249.83	14148.65	68.66	14229.91
45-64	N.A. versus White	2.27***	1.28**	1.58***	0.90
	-2LL	159.65	20818.50	56.58	20956.44
65+	N.A. versus White	1.85***	1.45***	1.42***	1.17*
	-2LL	52.59	6313.18	18.30	4420.90
		Bed Days		Doctor Visits	
		Model 1	Model 2	Model 1	Model 2
18-44	N.A. versus White	1.26***	0.81**	1.18***	1.08*
	-2LL	19.95	23226.83	21.91	28374.38
45-64	N.A. versus White	1.70***	1.15	1.19**	1.01
	-2LL	52.27	21736.11	7.71	12527.48
65+	N.A. versus White	1.42***	1.02	1.55***	1.38**
	-2LL	12.37	13086.98	17.71	5261.34

***: $p<0.01$, **: $p<0.05$, *: $p<0.10$

Note that model 1 only includes race; model 2 includes race, age, sex, marital status, region of residence, type of residence, education, income, employment status, and phone ownership. Model 2 for bed days additionally includes self-reported health and activity limitation and model 2 for doctor visits additionally includes self-reported health, activity limitation, and bed days.

Source: National Health Interview Survey 1986-1994

Table 4.1.9 presents the odds ratios of Native Americans versus Whites for different health indicators for the age groups of 18-44, 45-64, and 65+. Native Americans aged 18-44 are 151% more likely to report poor or fair health compared to their White counterparts. The odds ratio goes down to 2.27 and 1.85 for people aged 45-64 and 65+, respectively. Thus, Native Americans aged 45-64 are 127% more likely to report poor and fair health than their White counterparts, and the Native American elderly are only 85% more likely to report poor and fair health than their White counterparts. After adjusting for demographic and socioeconomic factors (see model 2), the odds ratios drop for each age, indicating that SES explains a large portion of the gap between Native Americans and Whites for self-reported health.

The fluctuation of odds ratios for activity limitation is not large and the change over age is not linear either. The odds ratio drops to the lowest for the elderly among the three age groups; however, Native Americans aged 45-64 are most likely to have an activity limitation in comparison to their White counterparts. When SES is controlled, the odds ratios for race drop and only the elderly odds ratio is significant.

For bed days, the peak odds ratio is in the 45-64 group: Native Americans aged 45-64 are 70% more likely to stay in bed for 7 or more days compared to their White counterparts. However, the gap of bed days does not close with age. Young Native American adults, compared to their White counterparts, are still more likely to stay in bed for 7 or more days, but the gap is smaller compared to

older adults. Again, after controlling for SES, all the odds ratios for race are significantly reduced.

The likelihood of Native Americans for having no doctor visits compared to their White counterparts increases with age. The two younger groups have similar odds ratios (1.18 and 1.19) compared to their White counterparts; yet the odds ratio for the elderly is about 0.36 higher (1.55). The reduction of the odds ratios in model 2 shows that having no doctor visits is strongly associated with SES.

In sum, these results demonstrate that compared to Whites, Native Americans with the aged 65 or older are less likely to report poor or fair health and to have activity limitations. Furthermore, they are relatively more likely to have no doctor visits. Thus, there seems to be a somewhat smaller race gap in health among the elderly, although unlike published mortality rates (as discussed in chapter one, this may be due to the age misreporting), there is no evidence that health among elderly Native Americans is actually better than Whites.

Place of Residence

This section examines health differences by place of residence. Native Americans in metropolitan areas are hypothesized to have better health outcomes than Native Americans living in non-metropolitan areas. Moreover, the health gap between MSA Native Americans and MSA Whites was hypothesized to be smaller than that between non-MSA Native Americans and non-MSA Whites.

The difference between MSA Native Americans and non-MSA Native Americans is shown in Table 4.1.10. As expected, non-MSA Native Americans

are more likely to report poor or fair health than MSA Native Americans (1.13);

Table 4.1.10:
Odds Ratios in Health by Place of Residence, Native American Adults

	Self-reported Health		Activity Limitation	
	Model 1	Model 2	Model 1	Model 2
Non-MSA N.A. v.s. MSA N.A	1.13*	0.88*	0.82*	0.70***
-2LL	3.12	781.37	9.03	854.07
	Bed Days		Doctor Visits	
	Model 1	Model 2	Model 1	Model 2
Non-MSA N.A. v.s. MSA N.A	0.89	0.94	1.15*	1.01
-2LL	2.37	842.85	5.53	660.14

***: p<0.01, **: p<0.05, *: p<0.10
Note that model 1 only includes race; model 2 includes race, age, sex, marital status, region of residence, type of residence, education, income, employment status, and phone ownership.
Model 2 on bed days additionally includes self-reported health and activity limitation and model 2 on doctor visits additionally includes self-reported health, activity limitation, and bed days.
Source: National Health Interview Survey 1986-1994

however, after controlling for SES, the difference reverses. Namely, a more advantaged socioeconomic profile for MSA Native Americans has a great impact on their health status. Furthermore, non-MSA Native Americans are more likely to have no doctor visits compared to MSA Native Americans probably because MSA Native Americans have better health care. Thus, the health differences among Native Americans do not always favor MSA residents. For example, non-MSA Native Americans are significantly less likely to have an activity limitation than MSA Native Americans.

Table 4.1.11 focuses on the health differentials between Native Americans and Whites by place of residence. Model 1 reveals that MSA Native Americans are 82% more likely to report poor or fair health than their White counterparts, while non-MSA Native Americans are 41% more likely to report poor or fair health than their White counterparts. Both odds ratios decrease when demographic and socioeconomic variables are controlled. Similarly, the racial differential for activity limitations in MSA areas is greater than that in non-MSA areas. MSA Native Americans are 42% more likely to have an activity limitation than their White counterparts while non-MSA Native Americans are 30% more likely to do so than their White counterparts. Moreover, MSA Native Americans are 24% more likely than Whites to have no doctor visits while non-MSA Native Americans are 27% more likely to have no doctor visits than Whites. When SES and health variables are controlled, there is no difference between non-MSA Native Americans and their White counterparts for bed days.

Table 4.1.11:
Odds Ratios for Race Differences in Health by Place of Residence, U.S. Adults

		Self-reported Health		Activity Limitation	
		Model 1	Model 2	Model 1	Model 2
MSA	Odds ratio N.A. v.s. White	1.82***	1.62***	1.42***	1.29***
	-2LL	140.46	45059.08	63.20	47941.75
Non-MSA	Odds ratio N.A. v.s. White	1.41***	1.33***	1.30***	0.80
	-2LL	45.41	23197.23	3.89	22994.53
		Bed Days		Doctor Visits	
		Model 1	Model 2	Model 1	Model 2
MSA	Odds ratio N.A. v.s. White	1.39***	0.97	1.24***	1.16***
	-2LL	40.79	42309.14	28.53	34949.30
Non-MSA	Odds ratio N.A. v.s. White	1.17	0.95	1.27***	1.06
	-2LL	7.17	17552.47	31.27	13800.47

***: $p<0.01$, **: $p<0.05$, *: $p<0.10$

Note that model 1 only includes race; model 2 includes race, age, sex, marital status, region of residence, type of residence, education, income, employment status, and phone ownership. Model 2 for bed days additionally includes self-reported health and activity limitation and model 2 for doctor visits additionally includes self-reported health, activity limitation, and bed days.

Source: National Health Interview Survey 1986-1994

With the exception of doctor visits, the health gaps between Native Americans and Whites in non-MSA areas are narrower than those in MSA areas. When SES or health variables are controlled, all racial gaps in non-MSA areas are narrower than those in MSA areas. This is counter to what was expected. However, it could be explained by the large SES gap between Native Americans and Whites in MSA areas than that in non-MSA areas and the prevalence of Indian Health Service on reservations.

4.2 Mortality

DESCRIPTIVE RESULTS

The data set used for mortality analysis is the NHIS linked with the Multiple Cause of Death Public Use Data File. Since the data set is rather similar to the one used in the previous section, the frequency distribution of independent variables are omitted. The frequency distribution for survival and cause of death is shown in Table 4.2.1. Surprisingly, the survival rates of Native Americans are higher than those of Whites. For example, 5.9% of non-MSA Native Americans died during the follow-up while 9% of non-MSA Whites died during the follow-up. This may be due to the younger age structure among Native Americans. Although it is not the main interest of this work, classifying people who died according to the International Cause of Death, Revision 9, during the follow-up into four main categories of cause of death elaborate the mortality profiles of these two populations. With the exception of social pathologies, as defined in chapter two, including external causes and cirrhosis of the liver, the unadjusted probabilities show that Native Americans have a lower risk of death from all causes of death. However, Native Americans, compared to Whites, are more likely to die from social pathologies.

Table 4.2.1:
Frequency Distribution of Outcome Variables for Native Americans and non-Hispanic Whites

	Native American		White	
	MSA	Non-MSA	MSA	Non-MSA
Outcome Variables				
Survival				
Died during follow-up	6.2[b]	5.9	7.7	9.0
Survival follow-up	93.8	94.1	92.3	91.0
Cause				
Circulatory diseases	2.2	1.9	3.3	3.9
Cancer	1.6	1.3	2.1	2.4
Social pathologies	0.5	1.1	0.4	0.5
Other causes	1.9	1.7	1.9	2.2
Total	**3122[a]**	**2410[a]**	**387,031[a]**	**140,943[a]**

Source: National Health Interview Survey 1986-1994 linked to Multiple Cause Death (MCD)
[a]: unweighted [b]: weighted

RACIAL DIFFERENCES IN MORTALITY: DEMOGRAPHIC, SOCIOECONOMIC, AND GEOGRAPHIC EFFECTS

Hypotheses for mortality include: 1) Native Americans have a higher risk of death than Whites, 2) the racial gap in mortality between these two populations narrows with age, 3) SES has a substantial impact on the mortality differential, 4) heath outcomes are strongly related to mortality, 5) MSA Native Americans have a lower risk of mortality than non-MSA Native Americans, and 6) the mortality gap between Native Americans and Whites in MSA areas is smaller than that in non-MSA areas.

Table 4.2.2 displays the mortality risk for Native Americans and Whites. As emphasized in Chapter 3, the hazards of dying are not proportional over age so that the odds ratios of Native Americans versus Whites are presented for three different age groups. The baseline model shows that the risk of death for Native Americans versus Whites decreases with age. The risk of death for Native Americans aged 18-44 is 56% higher than that for Whites. For people aged 45-64, the risk of death for Native Americans is 45% higher than that for Whites. For the elderly, the odds ratio is below one. The risks of death for these two populations are equivalent above age 65. However, especially in the case of mortality research, small cell sizes make it difficult to reach conventional levels of significance. The odds ratios do not change much after controlling for

Table 4.2.2: Adult Mortality Risks for Native Americans and Whites

	Hazard Ratio			
	Model 1	Model 2	Model 3	Model 4
Demographic Variables				
Ethnicity [White]				
Native American [18-44]	1.56**	1.20	0.99	1.53*
Native American [45-64]	1.45*	1.05	1.00	1.26
Native American [65+]	0.85	0.66**	0.72	0.68**
Sex [Female]				
Male		1.99***	2.19***	2.02***
Marital Status [Married]				
Unmarried		1.03	1.18***	1.17***
Geographic Variables				
Region [Northeast]				
Midwest		1.05	1.01	1.03*
South		0.98	0.93**	0.89
West		1.07*	1.07*	1.07*
Metropolitan [MSA]				
Non-MSA		1.08***	1.01	1.00
Socioeconomic Variables				
Education [13+ years]				
0-11 years			1.21***	1.06***
12 years			1.11***	1.08***
Income [$35,000+]				
$0-$9,999			1.67***	1.32***
$10,000-$19,999			1.43***	1.26***
$20,000-$34,999			1.28***	1.21***
Unknown			1.29***	1.19***
Employment [Employed]				
Unemployed			1.24***	1.13***
Not in labor force			1.60***	1.12***
Telephone [with phone]				
Without phone			1.18***	1.14**
Heath Variables				
Self-reported Health [Good]				
Poor				1.57***
Activity Limitation [not limited]				
Extremely limited				2.04***
Somewhat limited				1.40***
Days in Bed [0 days]				
1-7 days				0.95***
More than 7 days				1.38***
Doctor Visits [1-2 visits]				
0 visit				1.14***
More than 3 visits				1.19***
F	16536.18	8430.06	5907.68	4089.06

Source: National Health Interview Survey 1986-1994 linked to Multiple Cause Death (MCD)
Note that model 5 is dropped because the insignificance of the interaction term.

demographic variables. The odds ratios in model 2 suggest that males have a higher risk of death than females, and living in non-MSA areas is associated with a higher risk of death than living in MSA areas. When socioeconomic variables are added (see model 3), elderly Native Americans have a significantly lower risk of death than elderly Whites. The odds ratio of male versus female goes up significantly, meaning that males enjoy better SES than females, which amplifies their mortality gap with women. Although the magnitude is not as high as other SES indicators, phone ownership plays a role in mortality variation. The risk of death is 18% higher for the phoneless compared to those who have phones in the household. Model 4 shows that all health variables have strong association with mortality; people with activity limitations have a particularly high risk of death.

Table 4.2.3 presents mortality risk by place of residence. The risk patterns by age in non-MSA areas follows the previous table. Native Americans aged 18-44 have the highest risk, followed by the age group of 45-64, and the elderly. The risk for the Native American elderly is less than that for their White counterparts in non-MSA areas. Overall, the gap between Native Americans and Whites is larger in non-MSA areas than in MSA areas. The odds ratios are not significant either in MSA areas nor are they significant in non-MSA areas in the full model (model 2).

Table 4.2.3: Adult Mortality Risk of Native Americans and Whites by Age and Place of Residence

	Hazard Ratios			
	MSA		Non-MSA	
	Model 1	Model 2	Model 1	Model 2
Ethnicity [White]				
Native American 18-44	1.08	1.06	2.05**	1.22
Native American 45-64	1.26	1.26	1.80*	1.09
Native American 65+	0.88	0.86	0.64**	0.67
	12323.56	7536.22	4563.29	1505.00

Source: National Health Interview Survey 1986-1994 linked to Multiple Cause Death (MCD)
Model 1 only includes race; model 2 includes the demographic factors (race, age, sex, marital status), geographic factors (region of residence, type of residence), SES (education, income, employment status, and phone ownership), and health factors (self-reported health, activity limitations, bed days, doctor visits).
Note that two models (one including demographic variables and one including demographic and socioeconomic variables) are not shown due to insignificance of odds ratios.

4.3 Health Behavior

DESCRIPTIVE RESULTS

The NHIS 1986-1994 data are used for the general health section while the health risk behaviors are based on the 1997-2000 NHIS. It is likely that the population characteristics change over time. So, it is useful to start this section with an examination of the frequency distributions for the 1997-2000 period.

Indeed, a change is found in the distributions of age, education, income, living regions and place of residence compared to the 1986-1994 period (see Table 4.1.1 and Table 4.3.1). Over time, both Native Americans and Whites increase in the group aged 45-64 and decline in the group aged 18-44. Both populations improve socioeconomically. However, the improvement in family income for Native Americans is not as great as that for Whites. In terms of geographic distribution, Native Americans in the 1997-2000 period are less concentrated in the West and more urbanized. Note that the proportion of Native Americans in the West declined from 55.1% in the 1986-1994 data to 35.2% in 1997-2000 and the proportion of MSA Native Americans increased from 55.8% to 58.2% over this time period.

Table 4.3.2 shows the frequency distributions of health behaviors--drinking, smoking, and physical activity--for Native Americans and non-Hispanic Whites. Generally, Native Americans are more likely to smoke, less likely to be physically active, and less likely to drink compared with non-Hispanic Whites.

It has been pointed out that it is not the overall prevalence of drinking among Native Americans that is problematic, but rather the drinking style (May,

Table 4.3.1: Selected Frequency Distribution of Native Americans and Non-Hispanic Whites, 1997-2000

	Native American		White	
Demographic Variables	N[a]	%[b]	N[a]	%[b]
Mean Age	40.90		46.23	
Age				
18-44	590	62.8	41,392	51.1
45-64	273	28.3	26,457	30.5
65+	94	8.9	19,997	18.4
Sex				
Female	545	51.9	48,963	51.9
Male	412	48.1	38,883	48.1
Marital Status				
Coupled	446	58.0	49,133	67.2
Non-coupled	508	42.0	38,381	32.8
Socioeconomic Variables				
Education in years				
0-11	301	32.4	11,144	12.1
12	301	32.4	28,635	33.5
13+	350	35.2	47,384	54.4
Income				
$0-$9,999	235	21.6	6,922	6.2
$10,000-$19,999	228	22.1	12,167	12.2
$20,000-$34,999	172	20.2	17,752	20.2
$35,000+	176	20.7	32,732	40.5
Unknown	146	15.4	18,273	20.2
Geographic Variables				
Region				
Northeast	106	10.5	17,448	20.4
Midwest	184	21.5	24,989	29.3
South	303	32.8	29,216	33.8
West	364	35.2	16,193	16.5
Place of Residence				
MSA	617	58.2	66,832	75.6
Non-MSA	340	41.9	21,014	24.4
Total	**957**	**100**	**87,846**	**100**

Source: NHIS 1997-2000.
a: N is unweighted.
b: The percentages are weighted.

Table 4.3.2:
Frequency Distribution of Health Behaviors among Native Americans and Non-Hispanic Whites, 1997-2000

	Native American		White	
	N[a]	%[b]	N[a]	%[b]
Health Behavior				
Drinking				
Current drinker	524	55.2	56,810	66.4
light drinker	*448*	*46.4*	*53,216*	*62.2*
heavy drinker	*54*	*6.2*	*2,489*	*2.8*
Former drinker	226	23.1	14,006	15.4
Abstainer	196	21.7	15,707	18.2
Smoking				
Current smoker	339	35.9	21,657	24.7
light smoker	*175*	*18.1*	*7,872*	*9.0*
heavy smoker	*163*	*17.7*	*13,452*	*15.4*
Former smoker	204	21.2	22,625	25.5
Never smoke	412	43.0	42,886	49.8
Physical Activity				
Inactive	694	79.0	23,624	71.2
Active	190	21.0	57,762	28.8

Source: NHIS 1997-2000.
a: N is unweighted.
b: The percentages are weighted.

1994). Although Native Americans are less likely to drink, those who do consume alcohol are more likely to drink heavily than non-Hispanic Whites. Note that heavy drinking is defined here as consuming alcohol at least twice a week with more than five units on average. Approximately 55% of Native Americans are current drinkers while about 66% of non-Hispanic Whites are current drinkers. At the same time, more than 6% of Native Americans are heavy drinkers while less than 3% of non-Hispanic Whites are heavy drinkers.

One of the greatest health threats among Native Americans is the prevalence of smoking (Pego et. al., 1995). More than one-third of Native Americans smoke while about one-quarter of non-Hispanic Whites smoke. Nearly one-half of Native American smokers consume at least 15 cigarettes per day. The percentage of heavy smokers for Native Americans (17.68) is close to that for non-Hispanic Whites (15.42). However, non-Hispanic Whites are more likely to quit smoking and to never have smoked. The percentage who quit smoking or who never smoked for non-Hispanic Whites is about 75% and that for Native Americans is about 64%.

Some research indicates that physical inactivity is associated with Native American ethnicity, being female, older age, and having less education (Castro et. al., 2000). Not surprisingly, the NHIS data show that Native Americans have a higher rate of inactivity than Whites. About 29% of non-Hispanic Whites exercise moderately at least three times a week with duration more than 20 minutes while only 21% of Native Americans do so.

Table 4.3.3: Drinking Habits Among Native Americans and Non-Hispanic Whites, 1997-2000 (Weighted)

	Native American	White	Drinker N.A/White	Heavy N.A/White	Light N.A/White
Demographic Variables					
Age					
% 18-44	62.2	74.4	0.84	1.76	0.75
% 45-64	47.4	65.9	0.72	2.10	0.68
% 65+	30.5	44.8	0.68	10.65	0.58
Sex					
% Female	47.1	61.3	0.77	3.51	0.70
% Male	63.7	71.9	0.89	1.95	0.79
Marital Status					
% Married	54.6	67.8	0.80	2.83	0.72
% Unmarried	55.9	63.4	0.88	1.58	0.81
Socioeconomic Variables					
Education in years					
% 0-11	45.6	42.6	1.07	1.50	1.02
% 12	53.8	61.5	0.87	2.56	0.75
% 13+	65.3	74.8	0.87	2.36	0.81
Income					
% $0-$9,999	48.9	53.2	0.92	1.76	0.86
% $10,000-$19,999	51.9	53.4	0.97	1.51	0.93
% $20,000-$34,999	50.3	64.1	0.79	2.69	0.67
% $35,000+	73.2	77.2	0.95	1.61	0.90
Unknown	50.3	58.6	0.86	3.11	0.67
Geographic Variables					
Region					
% Northeast	59.8	74.0	0.81	2.08	0.68
% Midwest	57.3	68.7	0.83	2.00	0.76
% South	48.7	58.2	0.84	1.91	0.78
% West	58.5	69.4	0.84	2.89	0.74
Place of Residence					
% MSA	57.8	69.5	0.83	2.33	0.76
% Non-MSA	51.4	56.7	0.91	2.07	0.80

Source: NHIS 1997-2000.
Note that the ratios are calculated by the percentages with two decimal places though the percentages are reported with one decimal place.

As mentioned earlier, drinking intensity is an important health threat that Native Americans face today. Table 4.3.3 shows the drinking rates of Native Americans and non-Hispanic Whites, respectively, and the ratios of heavy drinking rates and light drinking rates for these two populations across the

selected covariates. It is found that Native Americans for all subgroups, with the exception of the group with less than 12 schooling years, are less likely to drink than Whites. However, at the same time, all the ratios exceed one for heavy drinking. This indicates that Native Americans tend to drink heavily compared to non-Hispanic Whites, regardless of demographic and socioeconomic characteristics. Note that the ratio for heavy drinking among the elderly is strikingly high, partly because of the small proportion of heavy drinkers for non-Hispanic Whites aged 65 or above. The ratio of female heavy drinkers also stands out (3.51), indicating that alcohol abuse is a problem for both Native American males and females. This table reveals drinking is positively associated with SES and inversely associated with age. That is, the rate of drinking increases as the level of education and income go up. And younger people tend to drink more than older individuals. Furthermore, men are more likely to drink than women and MSA residents are more likely to drink than non-MSA residents.

Table 4.3.4 shows similar information for smoking. The pattern of smoking is not as obvious as that of drinking for the comparison between Native Americans and non-Hispanic Whites across categories. It is found that the Native American elderly are far more likely to smoke than their counterparts (2.26). Furthermore, the prevalence of heavy smoking for the Native American elderly is even higher than their White counterparts (2.71). Unlike alcohol use, figures in this table indicate the inverse relation between smoking and SES. People with higher education are less likely to smoke. Like drinking, smoking is more

Table 4.3.4: Smoking Habits Among Native Americans and Non-Hispanic Whites, 1997-2000 (Weighted)

	Native American	White	Smoker N.A/White	Heavy N.A/White	Light N.A/White
Demographic Variables					
Age					
% 18-44	36.44	30.15	1.21	0.83	1.79
% 45-64	38.32	23.99	1.60	1.43	2.09
% 65+	23.82	10.55	2.26	2.71	1.62
Sex					
% Female	35.55	23.12	1.54	1.24	1.96
% Male	36.17	26.34	1.37	1.08	2.10
Marital Status					
% Married	35.62	22.68	1.57	1.31	2.10
% Unmarried	36.36	28.72	1.27	0.92	1.81
Socioeconomic Variables					
Education in years	39.75	34.23	1.16	0.73	2.27
% 0-11	36.81	30.67	1.20	0.99	1.68
% 12	31.42	18.83	1.67	1.51	1.90
% 13+					
Income	45.02	37.82	1.19	0.76	2.00
% $0-$9,999	35.45	32.77	1.08	0.71	1.82
% $10,000-$19,999	30.86	28.12	1.10	0.86	1.56
% $20,000-$34,999	34.76	20.01	1.74	1.79	1.70
% $35,000+	31.70	21.72	1.46	1.34	1.73
Unknown					
Geographic Variables					
Region	33.32	23.14	1.44	1.31	1.66
% Northeast	45.68	25.97	1.76	1.06	3.04
% Midwest	40.37	26.09	1.55	1.54	1.62
% South	26.37	21.32	1.24	0.78	1.55
% West					
Place of Residence	32.13	24.00	1.34	1.19	1.61
% MSA	41.02	26.74	1.53	1.01	2.70
% Non-MSA					

Source: NHIS 1997-2000.

Note that the ratios are calculated by the percentages with two decimal places though the percentages are reported with one decimal place.

prevalent at younger ages and living in non-MSA areas increases the likelihood of smoking. In particular, 41% of non-MSA Native Americans smoke, compared to 26.7% of non-MSA Whites.

With respect to physical inactivity, Native Americans are more likely to be physically inactive than non-Hispanic Whites as shown in Table 4.3.5. This table shows the rates of having a sedentary life style among Native Americans and non-Hispanic Whites and the corresponding ratios. The percentage range for all subgroups with a sedentary life style for Native Americans is between 69.7% and 87.5%. The range for non-Hispanic Whites is from 65.6% to 83.6%. All the ratios listed exceed one, meaning proportionately more Native Americans are inactive than non-Hispanic Whites across all demographic and social categories. For example, Native Americans living in the West are 17% more likely to have a sedentary life than their White counterparts. Like drinking, being physically active is positively associated with SES. People with higher education and income are more likely to exercise regularly.

In summary, non-Hispanic Whites tend to drink but they are less likely to drink heavily compared to Native Americans. With respect to smoking, the rates of heavy smoking for Native Americans and non-Hispanic Whites are close. However, compared with non-Hispanic Whites, the prevalence of smoking is about 10% higher among Native Americans. As expected, Native Americans are

Table 4.3.5:
Percent and Ratio of Native Americans and Non-Hispanic Whites with Sedentary Life, 1997-2000 (Weighted)

	Native American	White	N.A/White
Demographic Variables			
Age			
18-44	76.3	69.0	1.11
45-64	82.7	71.7	1.15
65+	86.9	76.5	1.14
Sex			
Female	81.6	70.1	1.16
Male	76.3	72.4	1.05
Marital Status			
Married	81.7	70.6	1.16
Unmarried	75.5	72.4	1.04
Socioeconomic Variables			
Education in years			
0-11	87.5	83.6	1.05
12	80.0	75.4	1.06
13+	69.7	65.6	1.06
Income			
$0-$9,999	79.2	76.6	1.03
$10,000-$19,999	81.9	77.0	1.06
$20,000-$34,999	81.1	71.7	1.13
$35,000+	69.1	65.9	1.05
Geographic Variables			
Region			
Northeast	80.2	69.2	1.16
Midwest	71.9	70.9	1.01
South	84.5	74.9	1.13
West	77.8	66.5	1.17
Place of Residence			
MSA	78.1	70.6	1.11
Non-MSA	80.2	73.2	1.10

Source: NHIS 1997-2000.
Note that the ratios are calculated by the percentages with two decimal places though the percentages are reported with one decimal place.

more likely to be physically inactive compared to non-Hispanic Whites. The patterns are rather consistent across demographic and socioeconomic sub-groups of these respective populations.

EXAMINING MODELS

Three models are used to examine drinking, smoking, and physical activity. The first model is the baseline model and only considers the effect of the race/ethnicity variable. The second model takes demographic and geographic variables into account. The third model, the full model, includes all the covariates. These models are used to test the following hypotheses: 1) Compared to Whites, Native Americans are more likely to drink and smoke and less likely to have leisure-time physical activity. 2) SES accounts for the higher risk of health behavior for Native Americans compared with Whites. Note that multinomial logistic regression is used to test models for drinking and smoking.

Alcohol Consumption

Since drinking includes three categories: non-drinking, light drinking, and heavy drinking, the multinomial logistic results of drinking are displayed in two tables (Table 4.3.6 and Table 4.3.7). Table 4.3.6 shows the odds ratio of heavy drinking, relative to non-drinking, and Table 4.3.7 shows that of light drinking, relative to non-drinking, between Native Americans and Whites. Model 1 in Table 4.3.6 reveals that the odds of heavy drinking for Native Americans are 64% higher than that for non-Hispanic Whites.

Table 4.3.6:
Odds Ratio of Heavy Drinking versus non-Drinking among Native Americans and Non-Hispanic Whites

	Model 1	Model 2	Model 3
Demographic Variables			
Race/Ethnicity [White]			
Native Americans	1.64***	1.34	1.43*
Age [65+]			
18-44		13.78***	12.24***
45-64		5.75***	5.16***
Sex [Female]			
Male		6.70***	6.58***
Marital Status [Unmarried]			
Married		0.51***	0.48***
Geographic Variables			
Region [Northeast]			
Midwest		0.93	0.92
South		0.60***	0.58***
West		0.78***	0.73***
Place of Residence [MSA]			
Non-MSA		0.73***	0.75***
Socioeconomic Variables			
Education in years [13+]			
0-11			0.89
12			1.00
Income [$35,000+]			
$0-$9,999			0.78***
$10,000-$19,999			0.78***
$20,000-$34,999			0.77***
Unknown			0.52***
Intercept	-2.52***	-5.05***	-4.61***
-2LL	91.78	9651.66	13683.32

Source: NHIS 1997-2000.

The odds ratio of Native Americans to non-Hispanic Whites in model 2 turns insignificant meaning no racial difference in alcohol consumption as the demographic and geographic variables are held constant. As the figures suggest in model 2, the younger generation and males have an amazingly higher tendency of

heavy drinking than their counterparts. That is, age and sex have extremely strong effects on heavy drinking. In particular, the odds of drinking for people aged 18-44 is 13.78 times that for people aged 65 and above. It also shows that unmarried individuals, people living in the Northeast, or in the MSAs are more likely to drink heavily.

When SES is additionally considered, Native Americans show 43% higher likelihood of heavy drinking than Whites. Although the racial difference in heavy drinking does not go away controlling for SES, unlike education, income has a relationship with heavy drinking such that people with income $35,000 and above are more likely to drink heavily than people with income less than $35,000. This may be due to the consumption ability.

Table 4.3.7 shows that Native Americans are 45% less likely to drink lightly than Whites (see model 1). When demographic and geographic factors are controlled, the odds ratio does not change substantially. Here, the magnitudes of age and sex effects are not as large as those for heavy drinking. The direction of marital effect changes—married people are more likely to drink lightly. When SES is further controlled, the odds ratio of Native Americans and Whites goes up from 0.53 to 0.72 and the approximately 20% increase is due to the confounding effect of the additional variables in model 3. Here, SES also shows a relationship

Table 4.3.7:
Odds Ratio of Light Drinking versus non-Drinking among Native Americans and Non-Hispanic Whites

	Model 1	Model 2	Model 3
Demographic Variables			
Race/Ethnicity [White]			
Native Americans	0.55***	0.53***	0.72**
Age [65+]			
18-44		3.31***	2.51***
45-64		2.23***	1.65***
Sex [Female]			
Male		1.43***	1.40***
Marital Status [Unmarried]			
Married		1.25***	1.10***
Geographic Variables			
Region [Northeast]			
Midwest		0.79***	0.77***
South		0.51***	0.50***
West		0.81***	0.72***
Place of Residence [MSA]			
Non-MSA		0.58***	0.69***
Socioeconomic Variables			
Education in years [13+]			
0-11			0.39***
12			0.63***
Income [$35,000+]			
$0-$9,999			0.48***
$10,000-$19,999			0.52***
$20,000-$34,999			0.66***
Unknown			0.52***
Intercept	0.58***	-0.09***	0.88***
-2LL	91.78	9651.66	13683.32

Source: NHIS 1997-2000.

with light drinking; however, in comparison with heavy drinking, the SES effect on light drinking is stronger. For example, people with less than 12 years of school are 61% less likely to drink lightly than people with more than 12 years of school; people with income less than $10,000 are 52% less likely to drink lightly than people with income more than $35,000.

Overall, SES is positively related to both heavy and light drinking. In other words, higher level of SES leads to higher likelihood of drinking. However, SES plays a more important role in light drinking than that in heavy drinking. For heavy drinking, age and sex are much stronger determinants.

Smoking

Again, owing to the multiple categories of smoking—non-smoking, light smoking and heavy smoking, the multinomial logistic results are displayed in two tables (Table 4.3.8 and Table 4.3.9).

The baseline model in Table 4.3.8 shows that the odds of heavy smoking for Native Americans is 1.35 times that for non-Hispanic Whites. There is no racial difference in heavy smoking when demographic and geographic variables are controlled. Coefficients in model 2 indicate that young adults, males, and non-MSA residents are more likely to smoke heavily. Those who are married or live in the West are less likely to smoke heavily. Like heavy drinking, age is a strong predictor of smoking. The odds of smoking for young adults are 1.21 times that for the elderly. There is no significant difference on smoking between Native

Table 4.3.8:
Odds Ratio of Heavy Smoking versus non-Smoking among Native Americans and Non-Hispanic Whites

	Model 1	Model 2	Model 3
Demographic Variables			
Race/Ethnicity [White]			
Native Americans	1.35**	1.21	0.84
Age [65+]			
18-44		3.73***	5.43***
45-64		3.44***	5.10***
Sex [Female]			
Male		1.42***	1.47***
Marital Status [Unmarried]			
Married		0.72***	0.80***
Geographic Variables			
Region [Northeast]			
Midwest		1.20***	1.21***
South		1.30***	1.25***
West		0.84***	0.92*
Place of Residence [MSA]			
Non-MSA		1.26***	0.98
Socioeconomic Variables			
Education in years [13+]			
0-11			3.46***
12			2.47***
Income [$35,000+]			
$0-$9,999			1.99***
$10,000-$19,999			1.87***
$20,000-$34,999			1.50***
Unknown			
Intercept	-1.59***	-2.85***	-3.98***
-2LL	75.36	4539.64	8519.91

Source: NHIS 1997-2000.

Americans and Whites in the full model. However, model 3 shows that smoking is inversely associated with SES.

Table 4.3.9 shows that Native Americans are 138% more likely to smoke lightly than Whites. When demographic and geographic variables are controlled, the odds ratio goes down to 2.09. Here, the coefficient suggests that males are less likely to smoke lightly than females. When SES is further controlled, the odds ratio between Native Americans and Whites drops to 1.65. SES shows a moderate inverse effect on light smoking.

Overall, Native Americans are more likely to smoke than Whites; however, the likelihood of light smoking is higher than that of heavy smoking. Age remains a strong predictor of both heavy smoking and light smoking. Males are more likely to smoke heavily but less likely to smoke lightly compared to females. SES has a relationship with smoking such that higher level of SES leads to lower likelihood of smoking. Indeed, SES has a stronger effect on heavy smoking than light smoking. Moreover, the magnitude of the education effect is larger than that of income.

Table 4.3.9:
Odds Ratio of Light Smoking versus non-Smoking among Native Americans and Non-Hispanic Whites

	Model 1	Model 2	Model 3
Demographic Variables			
Race/Ethnicity [White]			
Native Americans	2.38***	2.09***	1.65***
Age [65+]			
18-44		3.85***	4.74***
45-64		2.08***	2.62***
Sex [Female]			
Male		0.79***	0.82***
Marital Status [Unmarried]			
Married		0.62***	0.67***
Geographic Variables			
Region [Northeast]			
Midwest		0.98***	0.97
South		0.91**	0.88***
West		0.90**	0.93*
Place of Residence [MSA]			
Non-MSA		1.01	0.88***
Socioeconomic Variables			
Education in years [13+]			
0-11			1.84***
12			1.47***
Income [$35,000+]			
$0-$9,999			1.72***
$10,000-$19,999			1.61***
$20,000-$34,999			1.32***
Unknown			
Intercept	-2.13***	-2.66***	-3.24***
-2LL	75.36	4539.64	8519.91

Source: NHIS 1997-2000.

Physical Activity

Table 4.3.10 presents the odds ratios for being physically active. Native Americans are significantly less active physically than non-Hispanic Whites. The odds of being physically active for Native Americans are 0.66 times that for non-Hispanic Whites. Being physically active is associated with demographic, geographic, and socioeconomic variables. People with younger ages, female, living with their partners, living in the West, and living in MSA areas are more likely to exercise moderately and regularly as shown in model 2. Model 3 shows the inverse relationship between SES and being physically active. Furthermore, controlling for SES, the likelihood of being physically active with respect to non-Hispanic Whites increases. The odds ratio goes up from 0.62 in model 2 to 0.78 in model 3. However, when all covariates are controlled, the odds of having regular exercise for Native Americans is still lower than that for Non-Hispanic Whites (0.78).

Table 4.3.10:
Odds Ratio of being Physically Active among Native Americans and Non-Hispanic Whites

	Model 1	Model 2	Model 3
Demographic Variables			
Race/Ethnicity [White]			
Native Americans	0.66***	0.62***	0.78**
Age [65+]			
18-44		1.48***	1.17***
45-64		1.28***	1.02
Sex [Female]			
Male		0.88***	0.86***
Marital Status [Unmarried]			
Married		1.09***	1.01
Geographic Variables			
Region [Northeast]			
Midwest		0.92***	0.92***
South		0.76***	0.76***
West		1.13***	1.05
Place of Residence [MSA]			
Non-MSA		0.91***	1.03
Socioeconomic Variables			
Education in years [13+]			
0-11			0.45***
12			0.67***
Income [$35,000+]			
$0-$9,999			0.73***
$10,000-$19,999			0.72***
$20,000-$34,999			0.85***
Intercept	-0.91***	-1.06***	-0.45***
-2LL	23.49	828.55	2530.93

Source: NHIS 1997-2000.

CHAPTER 5

SUMMARY AND DISCUSSION

Summary

Although the health status for Native Americans has been improved, the gap with the general population remains. The goal of this work is to document the health gaps between Native Americans and non-Hispanic Whites using a recent, consistent, and national-level dataset—the National Health Interview Survey. This dissertation further investigates their relationship with age, place of residence, and socioeconomic status on account of the importance of these variables for Native American health. The health outcomes considered here are three-fold: general health indicators, mortality, and health behaviors. The general health indicators include self-reported health, activity limitations, days in bed, and doctor visits. In addition to demographic, geographic, and SES factors, the general health indicators are also included to examine the racial gap in mortality. Health behaviors consist of drinking, smoking and leisure-time physical activity.

This dissertation first states important theories of racial gaps in health. Based on these theories, hypotheses for general health, mortality, and health behaviors are posed. The empirical research and findings about the health of Native Americans are also reviewed to integrate with this work. Datasets

employed to examine the hypotheses are the 1986-1994 NHIS (general health), the 1986-1994 NHIS linked with the Multiple Cause of Death Public Use Data File (mortality), and the 1997-2000 NHIS (health behavior). Binomial and multinomial logistic regressions are used to analyze the racial gaps in general health and health behaviors; the piecewise constant exponential model with non-proportional effects is used to analyze the mortality data.

Descriptive findings confirmed that Native Americans are younger than Whites and less likely to be married or live with their partners. Native Americans are concentrated in the West and tend to live in MSA areas. As expected, Native Americans are worse off than Whites in terms of socioeconomic status. For example, the phoneless rate of Native Americans is about seven times that of Whites.

Recall that place of residence is a proxy of reservation/non-reservation residence in this work. The descriptive results find that people living in MSA areas tend to be younger than people living in non-MSA areas. Moreover, MSA residents are better off than non-MSA residents in terms of SES. Compared to Whites, both non-MSA and MSA Native Americans are disadvantaged. However, larger gaps are observed between MSA Native Americans and MSA Whites.

Several important health hypotheses are confirmed: Native Americans have poorer self-reported health and more activity limitations than Whites; Native

Americans are more likely to have no doctor visits than Whites; Native Americans spend more days in bed than Whites.

The importance of SES is substantiated. Native American-White differences in activity limitations and bed days are completely mediated by socioeconomic factors. SES also accounts for a large portion of the racial gap in self-reported health and physician utilization. Basically, individuals with disadvantaged SES such as lower levels of education and income, and being unemployed have a higher likelihood of reporting poor or fair health, having activity limitations, spending more days in bed and having no physician visits, compared to their more educated, affluent and working counterparts. Among SES factors, lack of phone ownership has a moderately important influence on the racial gaps in self-reported health and doctor visits. So, in addition to being an economic hardship indicator, phone ownership may also reflect social isolation. The reciprocal influence of SES and health suggested by earlier research (e.g., Mulatu and Schooler, 2002) must be recognized. For example, disability may lead to unemployment. Here, the reduction of SES effects on bed days as other health variables are controlled seems consistent with the reciprocal effect.

The racial gap in self-reported health between Native Americans and Whites narrows with age. However, similar patterns for activity limitations, bed days, and doctor visits are not observed.

The findings about place of residence are not exactly as expected. Although it is found that Native Americans living in metropolitan areas have better health outcomes than Native Americans living in non-metropolitan areas, non-MSA Native Americans are less likely to have an activity limitation and more likely to have no doctor visits than MSA Native Americans. With the exception of doctor visits, the health gaps between Native Americans and Whites in non-MSA areas are narrower than those in MSA areas. When SES or health variables are controlled, all racial gaps in non-MSA areas are narrower than those in MSA areas. This is counter to what was hypothesized.

As hypothesized, Native Americans are found to have a higher risk of death than Whites; the risk of death for Native Americans versus Whites declines with age. Native Americans aged 18-44 have the highest risk compared to their White counterparts, followed by the age group of 45-64, and then the elderly. However, SES does not show a great impact on mortality differentials between Native Americans and Whites. Indeed, the racial gap disappears between young adults after controlling for demographic characteristics. As expected, health is strongly associated with mortality; people with activity limitations have a particularly high risk of death. Although the risk for the Native American elderly is less than that for their White counterparts in non-MSA areas, the gap between Native Americans and Whites, overall, is larger in non-MSA areas than in MSA areas.

It is logical to assume that Native Americans are more likely, compared to Whites, to have unhealthy behaviors based on their worse health profiles. However, it is not as simple as that. Compared to Whites, Native Americans are less likely to drink but they are more likely to drink heavily. Generally, Native Americans are more likely to smoke than Whites; however, they do not necessarily smoke more heavily than Whites, especially after controlling for SES. Native Americans are more likely to be physically inactive compared to non-Hispanic Whites; however, it is unknown if Native Americans are more occupational physically active (i.e., the amount of work-related activity is unknown) than Whites and that further leads to lower likelihood of leisure-time physical inactivity.

As hypothesized, SES is inversely related with being physically inactive. However, the stories of drinking and smoking are somewhat complicated. Overall, SES is positively related to the likelihood of drinking. However, SES plays a more important role in light drinking than that in heavy drinking. For heavy drinking, age and sex are much stronger determinants. SES is inversely associated with the likelihood of smoking; indeed, the SES effect is stronger for heavy smoking than for light smoking. Moreover, among the SES variables, education has the strongest effect on smoking.

Discussion

The findings about place of residence are quite different from what were expected—the racial gaps in health and mortality in non-MSA areas turn out to be smaller than those in MSA areas. This may be due to the larger SES gaps in MSA areas between Native Americans and Whites, though non-MSA Native Americans are more socioeconomically disadvantaged than MSA Native Americans. And the wider gap of no physician visits between Native Americans and Whites in MSA areas than that in non-MSA areas may be partly due to the prevalence of the Indian Health Service, which provides universal health service regardless of levels of income on reservations. Note that about two-thirds of Native Americans qualified for IHS live in non-MSA areas. Although IHS is not optimal and often underutilized, at least it provides a "health safety net." In addition, the protection of the traditions and the religious beliefs on reservations may also reduce culture conflict and indirectly affect health (Young, 1997).

Undoubtedly, raising Native Americans' level of SES will be conducive to eliminating the Native American-White gap in health. However, it cannot be achieved overnight. The one-dollar telephone policy for Native Americans on reservations announced by the Clinton administration allows Native Americans on reservations to have access to telephone service by only paying one dollar monthly. It helps people experiencing economic hardships to reduce social isolation.

There are several limitations of this dissertation. First, the age effect in health here is not clearly established. And the findings about age in this work are somewhat inconsistent with an earlier research. McGee et. al. (1999) found a widening gap in self-reported health between Native Americans and Whites as age increases using the 1986-1994 NHIS data. The difference may result from different sample sizes. McGee et al. eliminated about 3% of the sample on account of the National Death Index mismatch, while I retain not only those mismatched individuals but also those who did not report their income. Thus, the sample size here is 929 greater and, perhaps, more representative of the U.S. population as a whole. Secondly, small sample size, particularly in mortality analysis, makes it difficult for estimates to achieve conventional levels of significance. Thirdly, the unavailability of some key information, such as reservation/non-reservation residence, limits the research. Occupational physical activity is another example. This work only documents leisure-time physical activity among Native Americans and Whites, though, as discussed earlier, occupational physical activity may also impact on individual's health.

Generally, health research for Native Americans is scant due to the unavailability of data or small size of samples of Native Americans. In the future, it is imperative to over-sample Native Americans in health surveys to allow for more national-level research. The racial differentials should continue to be the

focus in order to better understand the Native American health profile and reduce health disparities across race/ethnic and socioeconomic groups of the population.

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